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Standards of Performance for New Stationary Sources
A Compilation as of October 1, 1977

PEDCo-Environmental, Inc, Cincinnati, Ohio

Prepared for

Environmental Protection Agency, Washington, D C Div of Stationary Source Enforcement

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US ENVIRONMENTAL PROTECTION AGENCY
OFFICE of ENFORCEMENT
OFFICE of GENERAL ENFORCEMENT
WASHINGTON, D.C. 20460

STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

A COMPILATION AS OF OCTOBER 1, 1977

EPA-340/1-77-015
November 1977

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16. ABSTRACT

The Federal regulations for control of air pollution emissions from stationary sources, Standards of Performance for New Stationary Sources (NSPS), are continually being revised and new regulations added. A handbook has been prepared which compiles these regulations as well as the full text of all amendments and proposed amendments. It will be revised and updated periodically through supplements.

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STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES -

A COMPILATION AS OF OCTOBER 1, 1977

by

PEDCo Environmental, Inc.
Cincinnati, Ohio 45246

Contract No. 68-01-4147

EPA Project Officer: Kirk Foster

Prepared for

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Enforcement
Office of General Enforcement
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Washington, D.C. 20460

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The Stationary Source Enforcement series of reports is issued by the Office of General Enforcement, Environmental Protection Agency, to assist the Regional Offices in activities related to enforcement of implementation plans, new source emission standards, and hazardous emission standards to be developed under the Clean Air Act. Copies of Stationary Source Enforcement reports are available - as supplies permit - from the U.S. Environmental Protection Agency, Office of Administration, General Services Division, MD-35, Research Triangle Park, North Carolina 27711, or may be obtained, for a nominal cost, from the National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22151.

PREFACE

This document is a compilation of the New Source Performance Standards promulgated under Section 111 of the Clean Air Act, represented in full as amended. The information contained herein updates the original compilation published by the Environmental Protection Agency in August 1976 and Supplement I issued in March 1977 (EPA 340/1-76-009 and 340/1-76-009a).

The format of this document permits easy and convenient replacement of material as new standards are proposed and promulgated or existing standards revised. Section I is an introduction to the standards, explaining their purpose and interpreting the working concepts which have developed through their implementation. Section II contains a "quick-look" summary of each standard, including the dates of proposal, promulgation, and any subsequent revisions. Section III is the complete standards with all amendments incorporated into the material. Section IV contains the full text of all revisions, including the preamble which explains the rationale behind each revision. Section V is all proposed amendments to the standards. To facilitate the addition of future materials, the punched, loose-leaf format was selected. This approach permits the document to be placed in a three-ring binder or to be secured by rings, rivets, or other fasteners; future revisions can then be easily inserted.

Future Supplements to New Source Performance Standards - A Compilation will be issued on an as needed basis by the Division of Stationary Source Enforcement. Comments and suggestions regarding this document should be directed to: Standards Handbooks, Division of Stationary Source Enforcement (EN-341), U.S. Environmental Protection Agency, Washington, D.C. 20460.

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I INTRODUCTION

The Clean Air Act of 1970, building on prior Federal, state and local control agency legislation and experience, authorized a national program of air pollution prevention and control which included receptor/effect and specification standards, emission standards for mobile sources, and - for the first time - nationwide uniform emission standards for new and modified stationary sources. This is a compilation of the emission standards authorized in Section 111 of the Act: Standards of Performance for New Stationary Sources, commonly referred to as new source performance standards or NSPS.

Taking up less than two pages of the 56-page Clean Air Act, NSPS have become an important and integral part of Federal air pollution control activities. The major purpose of NSPS is that of preventing new air pollution problems. Section 111 of the 1970 Act, therefore, requires the application of the best adequately demonstrated system of emission reduction (taking into account the cost), permits control of existing sources which increase emissions, and can be applied to both new and existing sources of a pollutant not regulated by Sections 109 and 112. Standards may apply to specific equipment and processes, or to entire plants and facilities [Section 111(b)(2)], and may be revised whenever necessary. Since the standards are based on emissions, the owner or operator of a source may select any control system desired, but he must achieve the standard. Installation and operation of a control system is not enough: compliance is based on actual emissions. Finally, there is no provision for variances or exemptions; the NSPS must be met during normal operation (start-up, shutdown, and malfunction periods are provided for in specific regulations).

In developing NSPS or determining whether violations of NSPS have occurred, Section 114 of the Act permits EPA to require an owner or operator to keep records, make reports, monitor, sample emissions, and provide other information. Section 114 also grants EPA rights of entry, access to records and monitoring systems, and authority to sample emissions.

NSPS may be used to complement other standards (ambient air quality, hazardous pollutant, or mobile source), or may constitute the sole approach to controlling a specific air pollutant or air pollution source. The National Ambient Air Quality Standards (NAAQS) are attained through state implementation plans (SIP) and mobile source emission standards. The SIP are based on emission inventories. NSPS provide the standard test methods and accurate emission measurements required for a meticulous emission inventory. The emission measurements made during NSPS development can be used to support SIP regulations, and usually prove easier to enforce than a general regulation because they are tailored to specific sources. By imposing more stringent control on new sources, NSPS extend the usefulness of SIP's and of control equipment by reducing the rate at which emissions increase.

Protection of air quality is also aided by NSPS. No significant deterioration (non-degradation) regulations, as a minimum, require that SIP apply best available control technology to specified categories of new sources. Usually, NSPS will represent best technology. For sources not subject to NSPS, selection of best available control technology may be aided by NSPS studies and by transfer of NSPS-determined technology between similar industries.

Hazardous pollutant standards which do not require absolute best control to protect public health can be supplemented by NSPS that (1) minimize environmental accumulation of the pollutant if long-term effects are suspected and (2) increase margins of safety gradually, with less economic impact, by requiring best control of new sources. Even if the hazardous pollutant standard represents best existing technology, NSPS can be applied as control technology improves, increasing the margin of safety without penalizing existing plants.

Finally, NSPS can be used alone to control emissions of designated pollutants. This is the most feasible approach when emissions of a pollutant could endanger public health or welfare if not limited, but the number of existing sources is small. In situations where neither hazardous nor ambient air standards are justified, NSPS may be used. Public health could, for example, be endangered yet there could be insufficient data to set ambient air standards that would with certainty protect the public. Or a pollutant may affect public welfare, but not public health, another situation where NSPS could be used instead of the more complex SIP approach.

NSPS Working Concepts

The development of working concepts and standard-setting processes for both NSPS and hazardous pollutant standards reflects interpretations of the Act that have evolved, and continue to evolve, during its implementation.

Affected facility. The term "affected facility" does not appear in the Act, but is used in NSPS regulations to identify the equipment/system/process to which an NSPS applies. This concept permits full utilization of the authority in Section 111(b)(2) to "distinguish among classes, types, and sizes within categories." Affected facilities range from process equipment (cement plant kilns) to entire plants (asphalt concrete, nitric acid). Some NSPS exempt facilities below a specified size (steam generators, storage tanks). Distinctions may also be made between the materials used (different standards for coal, oil, and gas fired steam generators) or the material produced (different electric arc furnace standards for ferroalloys and steel production).

Standards of performance. Senate Report No. 91-1196 explains that this refers to the degree of control which can be achieved. EPA is to determine achievable limits and let the owner or operator determine the most economically acceptable technique to apply. The definition appearing in the 1970 Act contains two phrases which also require explanation:

(a) Emission limitations. This term refers to the maximum allowable quantity of concentration of pollutant that may be emitted to the atmosphere. Standard test methods are absolutely essential to the establishment of emission limitations, because different methods yield different results. The test method used to collect data for the standard must be used to determine compliance unless a correlation with other test methods is established. Several attempts have been made to correlate particulate matter test methods, but statistical analyses of these data indicate that sampling errors and process and other variations mask any correlation that may exist. Even if such correlations do exist, they will very probably differ for each source category.

An advantage of emission limitations is that any system of control may be applied; the owner/operator is responsible only for meeting the standard. This helps assure proper maintenance and permits innovative control techniques, but can create problems if well-designed, properly operated control equipment for some reason exceeds allowable emission levels. In addition, when a large number of small sources, such as stationary internal combustion engines, are involved, the cost of even a single performance test can be a significant fraction of the cost of the unit. For standardized units like gas turbines, prototype testing could be substituted, but a few categories (petroleum product storage tanks, for example) may best be regulated with equipment standards.

(b) Best system of emission reduction. In the selection of this system, the Act requires that the cost of achieving such reduction be taken into account and that the system be adequately demonstrated. The latter stipulation does not necessarily require that the system be in widespread use or even that it be in full-scale use at all. Experimental results could suffice, as could reasonable transfer of technology from one category to another. In practice, however, the system selected is usually the best available full-scale operating system. This should be expected, since a well-controlled existing plant provides actual cost figures, emission data, and operating and reliability information that experimental results cannot.

An NSPS applies nationwide over tremendous geographic, geologic, and climatic variations. Standards must therefore provide for differences in raw materials (whether friability of different coals affects coal cleaning plant emissions), weather (whether scrubbers can operate during Alaskan winters), operating parameters (whether seldom operated emergency power supply gas turbines should be controlled), and other factors. These variables are especially important because there is no provision for granting variances from NSPS, other than total exclusion or a separate NSPS.

Stationary sources. A stationary source is any potential or actual source of air pollution. This has come to include, by implication, the control system and ducting which handles the exhaust gases from the source. An affected facility is then a new or modified stationary source to which a standard applies.

Modification. Basically a modification is any change in an existing source which increases emissions. EPA has interpreted this as applying only to emissions to the atmosphere from sources for which NSPS have been proposed or promulgated, and has excluded some changes from the definition (such as increases in the hours of operation). Determination of modification can, however, become complex. The regulation defining modifications was promulgated on December 16, 1975.

Designated pollutants. When the pollutant for which an NSPS is set is not listed as either a hazardous (Section 112) or a criteria (Section 108) pollutant, it is defined as a designated pollutant and action under Section 111(d) of the Act is initiated. In a process similar to that required for state implementation plans, states are to establish existing source emission standards for this designated pollutant and submit control plans to EPA. Standards and control plans are required only for existing sources to which the NSPS apply if such sources were new sources.

Regulations establishing this procedure have been difficult to formulate; the role of state agencies in the determination of best control of existing sources is probably the most controversial issue. The regulation promulgated on November 17, 1975, specifies that EPA either issues guidelines (welfare pollutants) or an emission value (health pollutants) which states are to utilize in a manner analogous to the SIP process.

Continuous monitoring. The lack of a variance process, the need to account for nationwide process variations, and the implications of emission standards that must be attained: all point to the need for continuous air pollutant emission monitoring. Present manual source test methods require such a high investment in both funds and personnel that they may be used only once every six months or year to determine compliance. Such tests reveal almost nothing about the effect of process or raw material variations on emissions.

As a first step in improving emission data gathering and in moving toward the next step in emission standards, EPA is requiring continuous monitoring on certain pollutant-affected facility combinations. Regulations promulgated on October 6, 1975, specify performance criteria that continuous monitoring instruments installed as NSPS requirements must meet. Specified "continuous" data output ranges from the second-by-second opacity meter readings to the once every 15 minutes output from NO_x instruments.

This document contains all New Source Performance Standards, promulgated under Section 111 of the Clean Air Act, represented in full as amended. As more sources of pollution are investigated and new technology developed, the New Source Performance Standards will continue to be updated to achieve their primary purpose of preventing new air pollution problems.

Gary D. McCutchen
U.S. Environmental Protection Agency

SECTION II

SUMMARY OF STANDARDS AND REVISIONS

II. SUMMARY OF STANDARDS AND REVISIONS

In order to make the information in this document more easily acessible, a summary has been prepared of all New Source Performance Standards promulgated since their inception in December 1971. Anyone who must use the Federal Register frequently to refer to regulations published by Federal agencies is well aware of the problems of sifting through the many pages to extract the "meat" of a regulation. Although regulatory language is necessary to make the intent of a regulation clear, a more concise reference to go to when looking up a particular standard would be helpful. With this in mind, the following table was developed to assist those who work with the NSPS. It includes the categories of stationary sources and the affected facilities to which the standards apply; the pollutants which are regulated and the levels to which they must be controlled; and the requirements for monitoring emissions and operating parameters. Before developing standards for a particular source category, EPA must first identify the pollutants emitted and determine that they contribute significantly to air pollution which endangers public health or welfare. The standards are then developed and proposed in the Federal Register. After a period of time during which the public is encouraged to submit comments on the proposal, appropriate revisions are made to the regulations and they are promulgated in the Federal Register. To cite such a promulgation, it is common to refer to it by volume and page number, i.e. 36 FR 24876, which means Volume 36, page 24876 of the Federal Register. The table gives such references for the proposal, promulgation and subsequent revisions of each standard listed.

Linda S. Chaput
U.S. Environmental
Protection Agency

STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Source category	Affected facility	Pollutant	Emission level	Monitoring requirement
Subpart D - Fossil-Fuel Fired Steam Generators				
Proposed/effective 8/17/71 (36 FR 15704) Promulgated 12/23/71 (36 FR 24876)	Coal, coal/wood residue fired boilers >250 million Btu/hr	Particulate Opacity SO_2 NO_x	0.10 lb/10^6 Btu 20%; 40% 2 min/hr 1.2 lb/10^6 Btu 0.7 lb/10^6 Btu	No requirement Continuous Continuous* Continuous*
Revised 7/26/72 (37 FR 14877) 10/15/73 (38 FR 28564) 6/14/74 (39 FR 20790) 1/16/75 (40 FR 2803)	Oil, oil/wood residue fired boilers >250 million Bt/hr	Particulate Opacity SO_2 NO_x	0.10 lb/10^6 Btu 20%, 40% 2 min/hr 0.80 lb/10^6 Btu	No requirement Continuous Continuous*
10/6/75 (40 FR 46250) 12/22/75 (40 FR 59204) 11/22/76 (41 FR 51397) 1/31/77 (42 FR 5936)	Gas, gas/wood residue fired boilers >250 million Btu/hr	Particulate Opacity NO_x	0.10 lb/10^6 Btu 20%; 40% 2 min/hr 0.20 lb/10^6 Btu	No requirement Continuous* Continuous*
7/25/77 (42 FR 37936) 8/15/77 (42 FR 41122) 8/17/77 (42 FR 41122)	Mixed fossil fuel fired boilers >250 million Btu/hr	Particulate Opacity SO_2 NO_x (except lignite or 25% coal refuse)	0.10 lb/10^6 Btu 20%; 40% 2 min/hr Prorated Prorated	No requirement Continuous Continuous* Continuous* *exceptions; see standards
Subpart E - Incinerators				
Proposed/effective 8/17/71 (36 FR 15704)	Incinerators >50 tons/day	Particulate	0.08 gr/dscf corrected to 12% CO_2	No requirement
Promulgated 12/23/71 (36 FR 24876)				Daily charging rates and hours
Revised 6/14/74 (36 FR 20790) 7/25/77 (42 FR 37936) 8/17/77 (42 FR 41424)				

STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES (Continued)

Source category	Affected facility	Pollutant	Emission level	Monitoring requirement
Subpart F - Portland Cement Plants				
Proposed/effective 8/17/71 (36 FR 15704)	Kiln	Particulate Opacity	0.30 lb/ton 20%	No requirement No requirement
Promulgated 12/23/71 (36 FR 24876)	Clinker cooler	Particulate Opacity	0.10 lb/ton 10%	No requirement No requirement
Revised 6/14/74 (39 FR 20790) 11/12/74 (39 FR 39874) 10/6/75 (40 FR 46250) 7/25/77 (42 FR 37936) 8/17/77 (42 FR 41424)	Fugitive emission points	Opacity	10%	No requirement Daily production and feed kiln rates
Subpart G - Nitric Acid Plants				
Proposed/effective 8/17/71 (36 FR 15704)	Process equipment	Opacity NO_x	10% 3.0 lb/ton	No requirement Continuous
Promulgated 12/23/71 (36 FR 24876)				
Revised 5/23/73 (38 FR 13562) 10/15/73 (38 FR 28564) 6/14/74 (39 FR 20790) 10/6/75 (40 FR 46250) 7/25/77 (42 FR 37936) 8/17/77 (42 FR 41424)				Daily production rates and hours

STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES (Continued)

Source category	Affected facility	Pollutant	Emission level	Monitoring requirement
Subpart H - Sulfuric Acid Plants				
Proposed/effective 8/17/71 (36 FR 15704)	Process equipment	SO_2 Acid mist Opacity	4.0 lb/ton 0.15 lb/ton 10%	Continuous No requirement No requirement
Promulgated 12/23/71 (36 FR 24876)				
Revised 5/23/73 (38 FR 13562) 10/15/73 (38 FR 28564) 6/14/74 (39 FR 20790) 10/6/75 (40 FR 46250) 7/25/77 (42 FR 37936) 8/17/77 (42 FR 41424)				
Subpart I - Asphalt Concrete Plants				
Proposed/effective 6/11/73 (38 FR 15406)	Dryers; screening and weighing systems; storage, transfer, and loading systems; and dust handling equipment	Particulate	0.04 gr/dscf (90 mg/dscm)	No requirement
Promulgated 3/8/74 (39 FR 9308)		Opacity	20%	No requirement
Revised 10/6/75 (40 FR 46250) 7/25/77 (42 FR 37936) 8/17/77 (42 FR 41424)				
Subpart J - Petroleum Refineries				
Proposed/effective 6/11/73 (38 FR 15406)	Catalytic cracker	Particulate Opacity	1.0 lb/1000 lb 30% (6 min. exemption)	No requirement Continuous
Promulgated 3/8/74 (39 FR 9308)		CO	0.05%	
Revised 10/6/75 (40 FR 46250) 6/24/77 (42 FR 32426) 7/25/77 (42 FR 37936) 8/4/77 (42 FR 39389) 8/17/77 (42 FR 41424)	Fuel gas combustion	SO_2	0.1 gr H_2S/dscf (230 mg/dscm) fuel gas content	Continuous

STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES (Continued)

Source category	Affected facility	Pollutant	Emission level	Monitoring requirement
Subpart K - Storage Vessels for Petroleum Liquids Proposed/effective 6/11/73 (38 FR 15406) Promulgated 3/8/74 (39 FR 9308) Revised 4/17/74 (39 FR 13776) 6/14/74 (39 FR 20790) 7/25/77 (42 FR 37936) 8/17/77 (42 FR 41424)	Storage tanks >40,000 gal. capacity	Hydrocarbons	For vapor pressure 78-570 mm Hg, equip with floating roof, vapor recovery system, or equivalent; for vapor pressure >570 mm Hg, equip with vapor recovery system or equivalent	No requirement Date, type, vapor pressure and temperature
Subpart L - Secondary Lead Smelters Proposed/effective 6/11/73 (38 FR 15406) Promulgated 3/8/74 (39 FR 9308) Revised 4/17/74 (39 FR 13776) 10/6/75 (40 FR 46250) 7/25/77 (42 FR 37936) 8/17/77 (42 FR 41424)	Reverberatory and blast furnaces	Particulate	0.022 gr/dscf (50 mg/dscm)	No requirement
		Opacity	20%	No requirement
	Pot furnaces >550 lb/capacity	Opacity	10%	No requirement
Subpart M - Secondary Brass, Bronze and Ingot Production Plants Proposed/effective 6/11/73 (38 FR 15406) Promulgated 3/8/74 (39 FR 9308) Revised 10/6/75 (40 FR 46250) 7/25/77 (42 FR 37936) 8/17/77 (42 FR 41424)	Reverberatory furnace	Particulate	0.022 gr/dscf (50 mg/dscm)	No requirement
		Opacity	20%	No requirement
	Blast and electric furnaces	Opacity	10%	No requirement

STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES (Continued)

Source category	Affected facility	Pollutant	Emission level	Monitoring requirement
Subpart N - Iron and Steel Plants				
Proposed/effective 6/11/73 (38 FR 15406)	Basic oxygen process furnace	Particulate	0.022 gr/dscf (50 mg/dscm)	No requirement
Promulgated 3/8/74 (39 FR 9308)				
Revised 7/25/77 (42 FR 37936) 8/17/77 (42 FR 41424)				
Subpart O - Sewage Treatment Plants				
Proposed/effective 6/11/73 (38 FR 15406)	Sludge incinerators	Particulate Opacity	1.30 lb/ton 20%	No requirement No requirement
Promulgated 3/8/74 (39 FR 9308)				Mass or volume of sludge
Revised 4/17/74 (39 FR 13776) 5/3/74 (39 FR 15396) 10/6/75 (40 FR 46250) 7/25/77 (42 FR 37936) 8/17/77 (42 FR 41424)				
Subpart P - Primary Copper Smelters				
Proposed effective 10/16/74 (39 FR 37040)	Dryer	Particulate	0.022 gr/dscf 50 mg/dscm)	No requirement
Promulgated 1/15/76 (41 FR 2331)		Opacity	20%	Continuous
Revised 2/26/76 (41 FR 8346) 7/25/77 (42 FR 37936) 8/17/77 (42 FR 41424)	Roaster, smelting furnace,* copper converter	SO_2 Opacity	0.065% 20%	Continuous No requirement
	*Reverberatory furnaces that process high-impurity feed materials are exempt from SO_2 standard			Monthly record of charge and weight percent of arsenic, antimony, lead, and zinc

STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES (Continued)

Source category	Affected facility	Pollutant	Emission level	Monitoring requirement
Subpart Q - Primary Zinc Smelters				
Proposed/effective 10/16/74 (39 FR 37040)	Sintering machine	Particulate	0.022 gr/dscf (50 mg/dscm)	No requirement
		Opacity	20%	Continuous
Promulgated 1/51/76 (41 FR 2331)	Roaster	SO_2 Opacity	0.065% 20%	Continuous No requirement
Revised 7/25/77 (42 FR 37936) 8/17/77 (42 FR 41424)				
Subpart R - Primary Lead Smelters				
Proposed/effective 10/16/74 (39 FR 37040)	Blast or reverberatory furnace, sintering machine discharge end	Particulate	0.022 gr/dscf (50 mg/dscm)	No requirement
		Opacity	20%	Continuous
Promulgated 1/15/76 (41 FR 2331)	Sintering machine, electric smelting furnace, converter	SO_2 Opacity	0.065% 20%	Continuous No requirement
Revised 7/25/77 (42 FR 37936) 8/17/77 (42 FR 41424)				
Subpart S - Primary Aluminum Reduction Plants				
Proposed/effective 10/23/74 (39 FR 37730)	Potroom group (a) Soderberg plant (b) Prebake plant	(a) Total fluorides Opacity (b) Total fluorides Opacity	2.0 lb/ton 10% 1.9 lb/ton 10%	No requirement No requirement No requirement No requirement
Promulgated 1/26/76 (41 FR 3825)	Anode bake plants	Total fluorides Opacity	0.1 lb/ton 20%	No requirement No requirement
Revised 7/25/77 (42 FR 37936) 8/17/77 (42 FR 41424)				Daily weight, production rate of aluminum and anode raw material feed rate, cell or potline voltages

STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES (Continued)

Source category	Affected facility	Pollutant	Emission level	Monitoring requirement
Subpart T - Phosphate Fertilizer Industry Proposed/effective 10/22/74 (39 FR 37602) Promulgated 8/6/75 (40 FR 33152) Revised 7/25/77 (42 FR 37936) 8/17/77 (42 FR 41424)	Wet process phosphoric acid	Total fluorides	0.02 lb/ton	No requirement Mass flow rate, daily equivalent P_2O_5 feed, total pressure drop across scrubbing system
Subpart U - Phosphate Fertilizer Industry Proposed/effective 10/22/74 (39 FR 37602) Promulgated 8/6/75 (40 FR 33152) Revised 7/25/77 (42 FR 37936) 8/17/77 (42 FR 41424)	Superphosphoric acid	Total fluorides	0.01 lb/ton	No requirement Mass flow rate, daily equivalent P_2O_5 feed, total pressure drop across scrubbing system
Subpart V - Phosphate Fertilizer Industry Proposed/effective 10/24/74 (39 FR 37602) Promulgated 8/6/75 (40 FR 33152) Revised 7/25/77 (42 FR 37936) 8/17/77 (42 FR 41424)	Diammonium phosphate	Total fluorides	0.06 lb/ton	No requirement Mass flow rate, daily equivalent P_2O_5 feed, total pressure drop across scrubbing system

STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES (Continued)

Source category	Affected facility	Pollutant	Emission level	Monitoring requirement
Subpart W - Phosphate Fertilizer Industry Proposed/effective 10/22/74 (39 FR 37602) Promulgated 8/6/75 (40 FR 33152) Revised 7/25/77 (42 FR 37936) 8/17/77 (42 FR 41424)	Triple superphosphate	Total fluorides	0.2 lb/ton	No requirement Mass flow rate, daily equivalent P_2O_5 feed, total pressure drop across scrubbing system
Subpart X - Phosphate Fertilizer Industry Proposed/effective 10/22/74 (39 FR 37602) Promulgated 8/6/75 (40 FR 33152) Revised 7/25/77 (42 FR 37936) 8/17/77 (42 FR 41424)	Granular triple superphosphate	Total fluorides	5.0×10^{-4} lb/hr/ton	No requirement Mass flow rate, daily equivalent P_2O_5 feed, total pressure drop across scrubbing system
Subpart Y - Coal Preparation Plants Proposed/effective 10/24/74 (39 FR 37922) Promulgated 1/15/76 (41 FR 2232) Revised 7/25/77 (42 FR 37936) 8/17/77 (42 FR 41424) 9/7/77 (42 FR 44812)	Thermal dryer	Particulate	0.031 gr/dscf (0.070 g/dscm)	Temperature, Scrubber pressure loss, Water pressure
		Opacity	20%	No requirement
	Pneumatic coal cleaning equipment	Particulate	0.018 gr/dscf (0.040 g/dscm)	No requirement
		Opacity	10%	No requirement
	Processing and conveying equipment, storage systems, transfer and loading systems	Opacity	20%	No requirement

STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES (Continued)

Source category	Affected facility	Pollutant	Emission level	Monitoring requirement
Subpart Z - Ferroalloy Production Facilities				
Proposed/effective 10/21/74 (39 FR 37470) Promulgated 5/4/76 (41 FR 18497) Revised 5/20/76 (41 FR 20659) 7/25/77 (42 FR 37936) 8/17/77 (42 FR 41424)	Electric submerged arc furnaces	Particulate	0.99 lb/MW-hr (0.45 kg/MW-hr) ("high silicon alloys") 0.51 lb/MW-hr (0.23 kg/MW-hr) (chrome and manganese alloys)	No requirement
			No visible emissions may escape furnace capture system	Flowrate monitoring in hood
			No visible emission may escape tapping system for >40% of each tapping period	Flowrate monitoring in hood
		Opacity	15%	Continuous
		CO	20% volume basis	No requirement
	Dust handling equipment	Opacity	10%	No requirement
Subpart AA - Steel Plants				
Proposed/effective 10/21/74 (39 FR 37466) Promulgated 9/23/75 (40 FR 43850) Revised 7/25/77 (40 FR 37936) 8/17/77 (42 FR 41424) 9/7/77 (42 FR 44812)	Electric arc furnaces	Particulate	0.0052 gr/dscf (12 mg/dscm)	No requirement
		Opacity (a) control device	3%	Continuous
		(b) shop roof	0% except <20%-charging <40%-tapping	Flowrate monitoring in capture hood, Pressure monitoring in DSE system
	Dust handling equipment	Opacity	10%	No requirement

SECTION III

STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Title 40—PROTECTION OF ENVIRONMENT

Chapter I—Environmental Protection Agency

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AUTHORITY: Sec. 111, 301(a) of the Clean Air Act as amended (42 U.S.C. 1857c-6, 1857g (a)), unless otherwise noted. 68

Subpart A—General Provisions

§ 60.1 Applicability.[8,21]

Except as provided in Subparts B and C, the provisions of this part apply to the owner or operator of any stationary source which contains an affected facility, the construction or modification of which is commenced after the date of publication in this part of any standard (or, if earlier, the date of publication of any proposed standard) applicable to that facility.

§ 60.2 Definitions.

As used in this part, all terms not defined herein shall have the meaning given them in the Act:

(a) "Act" means the Clean Air Act (42 U.S.C. 1857 et seq., as amended by Public Law 91-604, 84 Stat. 1676).

(b) "Administrator" means the Administrator of the Environmental Protection Agency or his authorized representative.

(c) "Standard" means a standard of performance proposed or promulgated under this part.

(d) "Stationary source" means any building, structure, facility, or installation which emits or may emit any air pollutant and which contains any one or combination of the following:

(1) Affected facilities.

(2) Existing facilities.

(3) Facilities of the type for which no standards have been promulgated in this part.[22]

(e) "Affected facility" means, with reference to a stationary source, any apparatus to which a standard is applicable.

(f) "Owner or operator" means any person who owns, leases, operates, controls, or supervises an affected facility or a stationary source of which an affected facility is a part.

(g) "Construction" means fabrication, erection, or installation of an affected facility.

(h) "Modification" means any physical change in, or change in the method of operation of, an existing facility which increases the amount of any air pollutant (to which a standard applies) emitted into the atmosphere by that facility or which results in the emission of any air pollutant (to which a standard applies) into the atmosphere not previously emitted.[22]

(i) "Commenced" means, with respect to the definition of "new source" in section 111(a)(2) of the Act, that an owner or operator has undertaken a continuous program of construction or modification or that an owner or operator has entered into a contractual obligation to undertake and complete, within a reasonable time, a continuous program of construction or modification.[5]

(j) "Opacity" means the degree to which emissions reduce the transmission of light and obscure the view of an object in the background.

(k) "Nitrogen oxides" means all oxides of nitrogen except nitrous oxide, as measured by test methods set forth in this part.

(l) "Standard conditions" means a temperature of 20°C (68°F) and a pressure of 760 mm of Hg (29.92 in. of Hg).[5]

(m) "Proportional sampling" means sampling at a rate that produces a constant ratio of sampling rate to stack gas flow rate.

(n) "Isokinetic sampling" means sampling in which the linear velocity of the gas entering the sampling nozzle is equal to that of the undisturbed gas stream at the sample point.

(o) "Startup" means the setting in operation of an affected facility for any purpose.

(p) "Shutdown" means the cessation of operation of an affected facility for any purpose.[4]

(q) "Malfunction" means any sudden and unavoidable failure of air pollution control equipment or process equipment or of a process to operate in a normal or usual manner. Failures that are caused entirely or in part by poor maintenance, careless operation, or any other preventable upset condition or preventable equipment breakdown shall not be considered malfunctions.[4]

(r) "One-hour period" means any 60 minute period commencing on the hour.[4,18]

(s) "Reference method" means any method of sampling and analyzing for an air pollutant as described in Appendix A to this part.[5,8]

(t) "Equivalent method" means any method of sampling and analyzing for an air pollutant which have been demonstrated to the Administrator's satisfaction to have a consistent and quantitatively known relationship to the reference method, under specified conditions.[5]

(u) "Alternative method" means any method of sampling and analyzing for an air pollutant which is not a reference or equivalent method but which has been demonstrated to the Administrator's satisfaction to, in specific cases, produce results adequate for his determination of compliance.[5]

(v) "Particulate matter" means any finely divided solid or liquid material, other than uncombined water, as measured by Method 5 of Appendix A to this part or an equivalent or alternative method.[5,8]

(w) "Run" means the net period of time during which an emission sample is collected. Unless otherwise specified, a run may be either intermittent or continuous within the limits of good engineering practice.[5]

(x) "Six-minute period" means any one of the 10 equal parts of a one-hour period.[18]

(y) "Continuous monitoring system" means the total equipment, required under the emission monitoring sections in applicable subparts, used to sample and condition (if applicable), to analyze, and to provide a permanent record of emissions or process parameters.[18]

(z) "Monitoring device" means the total equipment, required under the monitoring of operations sections in applicable subparts, used to measure and record (if applicable) process parameters.[18]

(aa) "Existing facility" means, with reference to a stationary source, any apparatus of the type for which a standard is promulgated in this part, and the construction or modification of which was commenced before the date of proposal of that standard; or any apparatus which could be altered in such a way as to be of that type.[22]

(bb) "Capital expenditure" means an expenditure for a physical or operational change to an existing facility which exceeds the product of the applicable "annual asset guideline repair allowance percentage" specified in the latest edition of Internal Revenue Service Publication 534 and the existing facility's basis, as defined by section 1012 of the Internal Revenue Code.[22]

§ 60.3 Units and abbreviations.[5,62]

Used in this part are abbreviations and symbols of units of measure. These are defined as follows:

(a) System International (SI) units of measure:

A—ampere
g—gram
Hz—hertz
J—joule
K—degree Kelvin
kg—kilogram
m—meter
m³—cubic meter
mg—milligram—10^{-3} gram
mm—millimeter—10^{-3} meter
Mg—megagram—10^{6} gram
mol—mole
N—newton
ng—nanogram—10^{-9} gram
nm—nanometer—10^{-9} meter
Pa—pascal
s—second
V—volt
W—watt
Ω—ohm
μg—microgram—10^{-6} gram[65]

(b) Other units of measure:

Btu—British thermal unit
°C—degree Celsius (centigrade)
cal—calorie
cfm—cubic feet per minute
cu ft—cubic feet
dcf—dry cubic feet
dcm—dry cubic meter
dscf—dry cubic feet at standard conditions
dscm—dry cubic meter at standard conditions
eq—equivalent
°F—degree Fahrenheit
ft—feet
gal—gallon
gr—grain
g-eq—gram equivalent
hr—hour
in—inch
k—1,000

l—liter
lpm—liter per minute
lb—pound
meq—milliequivalent
min—minute
ml—milliliter
mol. wt.—molecular weight
ppb—parts per billion
ppm—parts per million
psia—pounds per square inch absolute
psig—pounds per square inch gage
°R—degree Rankine
scf—cubic feet at standard conditions
scfh—cubic feet per hour at standard conditions
scm—cubic meter at standard conditions
sec—second
sq ft—square feet
std—at standard conditions

(c) Chemical nomenclature:

CdS—cadmium sulfide
CO—carbon monoxide
CO_2—carbon dioxide
HCl—hydrochloric acid
Hg—mercury
H_2O—water
H_2S—hydrogen sulfide
H_2SO_4—sulfuric acid
N_2—nitrogen
NO—nitric oxide
NO_2—nitrogen dioxide
NO_x—nitrogen oxides
O_2—oxygen
SO_2—sulfur dioxide
SO_3—sulfur trioxide
SO_x—sulfur oxides

(d) Miscellaneous:

A.S.T.M.—American Society for Testing and Materials

(Sections 111 and 301(a) of the Clean Air Act; sec. 4(a) of Pub. L. 91–604, 84 Stat. 1683; sec. 2 of Pub. L. 90–148, 81 Stat. 504 (42 U.S.C. 1857c–6, 1857g(a)).)

§ 60.4 Address. [5,12]

(a) All requests, reports, applications, submittals, and other communications to the Administrator pursuant to this part shall be submitted in duplicate and addressed to the appropriate Regional Office of the Environmental Protection Agency, to the attention of the Director, Enforcement Division. The regional offices are as follows:

Region I (Connecticut, Maine, New Hampshire, Massachusetts, Rhode Island, Vermont), John F. Kennedy Federal Building, Boston, Massachusetts 02203.

Region II (New York, New Jersey, Puerto Rico, Virgin Islands), Federal Office Building, 26 Federal Plaza (Foley Square), New York, N.Y. 10007.

Region III (Delaware, District of Columbia, Pennsylvania, Maryland, Virginia, West Virginia), Curtis Building, Sixth and Walnut Streets, Philadelphia, Pennsylvania 19106.

Region IV (Alabama, Florida, Georgia, Mississippi, Kentucky, North Carolina, South Carolina, Tennessee), Suite 300, 1421 Peachtree Street, Atlanta, Georgia 30309.

Region V (Illinois, Indiana, Minnesota, Michigan, Ohio, Wisconsin), 230 South Dearborn Street, Chicago, Illinois 60604. [59]

Region VI (Arkansas, Louisiana, New Mexico, Oklahoma, Texas), 1600 Patterson Street, Dallas, Texas 75201.

Region VII (Iowa, Kansas, Missouri, Nebraska), 1735 Baltimore Street, Kansas City, Missouri 63108.

Region VIII (Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming), 196 Lincoln Towers, 1860 Lincoln Street, Denver, Colorado 80203.

Region IX (Arizona, California, Hawaii, Nevada, Guam, American Samoa), 100 California Street, San Francisco, California 94111.

Region X (Washington, Oregon, Idaho, Alaska), 1200 Sixth Avenue, Seattle, Washington 98101.

(b) Section 111(c) directs the Administrator to delegate to each State, when appropriate, the authority to implement and enforce standards of performance for new stationary sources located in such State. All information required to be submitted to EPA under paragraph (a) of this section, must also be submitted to the appropriate State Agency of any State to which this authority has been delegated (provided, that each specific delegation may except sources from a certain Federal or State reporting requirement). The appropriate mailing address for those States whose delegation request has been approved is as follows:

(A) [reserved].

(B) State of Alabama, Air Pollution Control Division, Air Pollution Control Commission, 645 S. McDonough Street, Montgomery, Alabama 36104 [45]

(C) [reserved].

D—Arizona
Pima County Air Pollution Control District, 151 West Congress Street, Tucson, AZ 85701. [51]

(E) [reserved].

F—California:
Bay Area Air Pollution Control District, 939 Ellis Street, San Francisco, CA 94109.
Del Norte County Air Pollution Control District, Courthouse, Crescent City, CA 95531.
Fresno County Air Pollution Control District, 515 S. Cedar Avenue, Fresno, CA 93702.
Humboldt County Air Pollution Control District, 5600 S. Broadway, Eureka, CA 95501.
Kern County Air Pollution Control District, 1700 Flower Street (P.O. Box 997), Bakersfield, CA 93302.
Madera County Air Pollution Control District, 135 W. Yosemite Avenue, Madera, CA 93637.
Mendocino County Air Pollution Control District, County Courthouse, Ukiah, CA 95482.
Monterey Bay Unified Air Pollution Control District, 420 Church Street (P.O. Box 487) Salinas, CA 93901.
Northern Sonoma County Air Pollution Control District, 3313 Chanate Road, Santa Rosa, CA 95404.
Sacramento County Air Pollution Control District, 3701 Branch Center Road, Sacramento, CA 95827.
San Diego County Air Pollution Control District, 9150 Chesapeake Drive, San Diego, CA 92123.
San Joaquin County Air Pollution Control District, 1601 E. Hazelton Street (P.O. Box 2009) Stockton, CA 95201.
Santa Barbara County Air Pollution Control District, 4440 Calle Real, Santa Barbara, CA 93110.
Stanislaus County Air Pollution Control District, 820 Scenic Drive, Modesto, CA 95350.
Trinity County Air Pollution Control District, Box AJ, Weaverville, CA 96093.
Ventura County Air Pollution Control District, 625 E. Santa Clara Street, Ventura, CA 93001. [15,17,36,40,44,48,52]

(G)—State of Colorado, Colorado Air Pollution Control Division, 4210 East 11th Avenue, Denver, Colorado 80220. [20]

(H) State of Connecticut, Department of Environmental Protection, State Office Building, Hartford, Connecticut 06115. [31]

(I) – (K) [reserved].

(L) State of Georgia, Environmental Protection Division, Department of Natural Resources, 270 Washington Street, S.W., Atlanta, Georgia 30334. [38]

(M) [reserved].

(N) State of Idaho, Department of Health and Welfare, Statehouse, Boise, Idaho, 83701. [13]

(O) [reserved].

(P) State of Indiana, Indiana Air Pollution Control Board, 1330 West Michigan Street, Indianapolis, Indiana 46206. [46]

(Q) State of Iowa, Department of Environmental Quality, 3920 Delaware, P.O. Box 3326, Des Moines, Iowa 50316. [54]

(R)-(T) [reserved]

(U) State of Maine, Department of Environmental Protection, State House, Augusta, Maine 04330. [24]

(V) [reserved].

(W) Massachusetts Department of Environmental Quality Engineering, Division of Air Quality Control, 600 Washington Street, Boston, Massachusetts 02111. [34]

(X)—State of Michigan, Air Pollution Control Division, Michigan Department of Natural Resources, Stevens T. Mason Building, 8th Floor, Lansing, Michigan 48926 [25]

(Y), (Z) [reserved].

(AA) [reserved].

(BB) State of Montana, Department of Health and Environmental Services, Cogswell Building, Helena, Mont. 59601. [70]

(CC) Nebraska Department of Environmental Control, P.O. Box 94653, State House Station, Lincoln, Nebraska 68509. [34]

(DD) [reserved].

(EE) New Hampshire Air Pollution Control Agency, Department of Health and Welfare, State Laboratory Building, Hazen Drive, Concord, New Hampshire 03301. [34]

(FF)—State of New Jersey: New Jersey Department of Environmental Protection, John Fitch Plaza, P.O. Box 2807, Trenton, New Jersey 08625. [63]

(GG) [reserved].

(HH)—New York: New York State Department of Environmental Conservation, 50 Wolf Road, New York 12233, attention: Division of Air Resources. [19]

(II) North Carolina Environmental Management Commission, Department of Natural and Economic Resources, Division of Environmental Management, P.O. Box 27687, Raleigh, North Carolina 27611. Attention: Air Quality Section.[34]

(JJ)—State of North Dakota, State Department of Health, State Capitol, Bismarck, North Dakota 58501.[47]

(KK) Ohio—

Medina, Summit and Portage Counties; Director, Air Pollution Control, 177 South Broadway, Akron, Ohio, 44308.

Stark County; Director, Air Pollution Control Division, Canton City Health Department, City Hall, 218 Cleveland Avenue SW, Canton, Ohio, 44702.

Butler, Clermont, Hamilton and Warren Counties; Superintendent, Division of Air Pollution Control, 2400 Beekman Street, Cincinnati, Ohio, 45214.

Cuyahoga County; Commissioner, Division of Air Pollution Control, Department of Public Health and Welfare, 2735 Broadway Avenue, Cleveland, Ohio, 44115.

Lorain County; Control Officer, Division of Air Pollution Control, 200 West Erie Avenue, 7th Floor, Lorain, Ohio, 44052.

Belmont, Carroll, Columbiana, Harrison, Jefferson, and Monroe Counties; Director, North Ohio Valley Air Authority (NOVAA), 814 Adams Street, Steubenville, Ohio, 43952.

Clark, Darke, Greene, Miami, Montgomery, and Preble Counties; Supervisor, Regional Air Pollution Control Agency (RAPCA), Montgomery County Health Department, 451 West Third Street, Dayton, Ohio, 45402.

Lucas County and the City of Rossford (in Wood County); Director, Toledo Pollution Control Agency, 26 Main Street, Toledo, Ohio, 43605.

Adams, Brown, Lawrence, and Scioto Counties; Engineer-Director, Air Division, Portsmouth City Health Department, 740 Second Street, Portsmouth, Ohio, 45662.

Allen, Ashland, Auglaize, Crawford, Defiance, Erie, Fulton, Hancock, Hardin, Henry, Huron, Knox, Marion, Mercer, Morrow, Ottawa, Paulding, Putnam, Richland, Sandusky, Seneca, Van Wert, Williams, Wood (except City of Rossford), and Wyandot Counties; Ohio Environmental Protection Agency, Northwest District Office, 111 West Washington Street, Bowling Green, Ohio, 43402.

Ashtabula, Geauga, Lake, Mahoning, Trumbull, and Wayne Counties; Ohio Environmental Protection Agency, Northeast District Office, 2110 East Aurora Road, Twinsburg, Ohio, 44087.

Athens, Coshocton, Gallia, Guernsey, Highland, Hocking, Holmes, Jackson, Meigs, Morgan, Muskingum, Noble, Perry, Pike, Ross, Tuscarawas, Vinton, and Washington Counties; Ohio Environmental Protection Agency, Southeast District Office, Route 3, Box 603, Logan, Ohio, 43138.

Champaign, Clinton, Logan, and Shelby Counties; Ohio Environmental Protection Agency, Southwest District Office, 7 East Fourth Street, Dayton, Ohio, 45402.

Delaware, Fairfield, Fayette, Franklin, Licking, Madison, Pickaway, and Union Counties; Ohio Environmental Protection Agency, Central District Office, 360 East Broad Street, Columbus, Ohio, 43215.[33]

(LL) [reserved].

(MM)—State of Oregon, Department of Environmental Quality, 1234 SW Morrison Street, Portland, Oregon 97205.[29]

(NN) (a) City of Philadelphia: Philadelphia Department of Public Health, Air Management Services, 801 Arch Street, Philadelphia, Pennsylvania 19107.[38]

(OO) [reserved].

(PP) State of South Carolina, Office of Environmental Quality Control, Department of Health and Environmental Control, 2600 Bull Street, Columbia, South Carolina 29201.[34]

(QQ) State of South Dakota, Department of Environmental Protection, Joe Foss Building, Pierre, South Dakota 57501.[32]

(RR), (SS) [reserved].

(TT)—State of Utah, Utah Air Conservation Committee, State Division of Health, 44 Medical Drive, Salt Lake City, Utah 84113.[37]

(UU)—State of Vermont, Agency of Environmental Protection, Box [illegible], Montpelier, Vermont 05602.[35]

(VV) Commonwealth of Virginia, Virginia State Air Pollution Control Board Room 1106, Ninth Street Office Building Richmond, Virginia 23219.[30]

(WW) (i) Washington: State of Washington, Department of Ecology, Olympia, Washington 98504.

(ii) Northwest Air Pollution Authority, 207 Pioneer Building, Second and Pine Streets, Mount Vernon, Washington 98273.

(iii) Puget Sound Air Pollution Control Agency, 410 West Harrison Street, Seattle, Washington 98119.

(iv) Spokane County Air Pollution Control Authority, North 811 Jefferson, Spokane, Washington 99201.

(v) Southwest Air Pollution Control Authority, Suite 7601 H, NE Hazel Dell Avenue, Vancouver, Washington 98665.[12,28]

(XX) [reserved].

(YY) Wisconsin—

Wisconsin Department of Natural Resources, P.O. Box 7921, Madison, Wisconsin 53707.[39]

(ZZ) State of Wyoming, Air Quality Division of the Department of Environmental Quality, Hathaway Building, Cheyenne, Wyo. 82002.[72]

(AAA), (BBB) [reserved].

(CCC)—U.S. Virgin Islands: U.S. Virgin Islands Department of Conservation and Cultural Affairs, P.O. Box 578, Charlotte Amalie, St. Thomas, U.S. Virgin Islands 00801.[41]

(DDD) [reserved].

§ 60.5 Determination of construction or modification.[22]

(a) When requested to do so by an owner or operator, the Administrator will make a determination of whether action taken or intended to be taken by such owner or operator constitutes construction (including reconstruction) or modification or the commencement thereof within the meaning of this part.

(b) The Administrator will respond to any request for a determination under paragraph (a) of this section within 30 days of receipt of such request.

§ 60.6 Review of plans.

(a) When requested to do so by an owner or operator, the Administrator will review plans for construction or modification for the purpose of providing technical advice to the owner or operator.

(b) (1) A separate request shall be submitted for each construction or modification project.[5]

(2) Each request shall identify the location of such project, and be accompanied by technical information describing the proposed nature, size, design, and method of operation of each affected facility involved in such project, including information on any equipment to be used for measurement or control of emissions.[5]

(c) Neither a request for plans review nor advice furnished by the Administrator in response to such request shall (1) relieve an owner or operator of legal responsibility for compliance with any provision of this part or of any applicable State or local requirement, or (2) prevent the Administrator from implementing or enforcing any provision of this part or taking any other action authorized by the Act.

§ 60.7 Notification and record keeping.

(a) Any owner or operator subject to the provisions of this part shall furnish the Administrator written notification as follows:

(1) A notification of the date construction (or reconstruction as defined under § 60.15) of an affected facility is commenced postmarked no later than 30 days after such date. This requirement shall not apply in the case of mass-produced facilities which are purchased in completed form.[22]

(2) A notification of the anticipated date of initial startup of an affected facility postmarked not more than 60 days nor less than 30 days prior to such date.[22]

(3) A notification of the actual date of initial startup of an affected facility postmarked within 15 days after such date.[22]

(4) A notification of any physical or operational change to an existing facility which may increase the emission rate of any air pollutant to which a standard applies, unless that change is specifically exempted under an applicable

subpart or in § 60.14(e) and the exemption is not denied under § 60.14(d)(4). This notice shall be postmarked 60 days or as soon as practicable before the change is commenced and shall include information describing the precise nature of the change, present and proposed emission control systems, productive capacity of the facility before and after the change, and the expected completion date of the change. The Administrator may request additional relevant information subsequent to this notice.[22]

(5) A notification of the date upon which demonstration of the continuous monitoring system performance commences in accordance with § 60.13(c). Notification shall be postmarked not less than 30 days prior to such date.[18]

(b) Any owner or operator subject to the provisions of this part shall maintain records of the occurrence and duration of any startup, shutdown, or malfunction in the operation of an affected facility; any malfunction of the air pollution control equipment; or any periods during which a continuous monitoring system or monitoring device is inoperative.[18]

(c) Each owner or operator required to install a continuous monitoring system shall submit a written report of excess emissions (as defined in applicable subparts) to the Administrator for every calendar quarter. All quarterly reports shall be postmarked by the 30th day following the end of each calendar quarter and shall include the following information:[18]

(1) The magnitude of excess emissions computed in accordance with § 60.13(h), any conversion factor(s) used, and the date and time of commencement and completion of each time period of excess emissions.[18]

(2) Specific identification of each period of excess emissions that occurs during startups, shutdowns, and malfunctions of the affected facility. The nature and cause of any malfunction (if known), the corrective action taken or preventative measures adopted.[18]

(3) The date and time identifying each period during which the continuous monitoring system was inoperative except for zero and span checks and the nature of the system repairs or adjustments.[18]

(4) When no excess emissions have occurred or the continuous monitoring system(s) have not been inoperative, repaired, or adjusted, such information shall be stated in the report.[4, 18]

(d) Any owner or operator subject to the provisions of this part shall maintain a file of all measurements, including continuous monitoring system, monitoring device, and performance testing measurements; all continuous monitoring system performance evaluations; all continuous monitoring system or monitoring device calibration checks; adjustments and maintenance performed on these systems or devices; and all other information required by this part recorded in a permanent form suitable for inspection. The file shall be retained for at least two years following the date of such measurements, maintenance, reports, and records.[5, 18]

(e) If notification substantially similar to that in paragraph (a) of this section is required by any other State or local agency, sending the Administrator a copy of that notification will satisfy the requirements of paragraph (a) of this section.[22]

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).).[68]

§ 60.8 Performance tests.

(a) Within 60 days after achieving the maximum production rate at which the affected facility will be operated, but not later than 180 days after initial startup of such facility and at such other times as may be required by the Administrator under section 114 of the Act, the owner or operator of such facility shall conduct performance test(s) and furnish the Administrator a written report of the results of such performance test(s).

(b) Performance tests shall be conducted and data reduced in accordance with the test methods and procedures contained in each applicable subpart unless the Administrator (1) specifies or approves, in specific cases, the use of a reference method with minor changes in methodology, (2) approves the use of an equivalent method, (3) approves the use of an alternative method the results of which he has determined to be adequate for indicating whether a specific source is in compliance, or (4) waives the requirement for performance tests because the owner or operator of a source has demonstrated by other means to the Administrator's satisfaction that the affected facility is in compliance with the standard. Nothing in this paragraph shall be construed to abrogate the Administrator's authority to require testing under section 114 of the Act.[5]

(c) Performance tests shall be conducted under such conditions as the Administrator shall specify to the plant operator based on representative performance of the affected facility. The owner or operator shall make available to the Administrator such records as may be necessary to determine the conditions of the performance tests. Operations during periods of startup, shutdown, and malfunction shall not constitute representative conditions of performance tests unless otherwise specified in the applicable standard.[4]

(d) The owner or operator of an affected facility shall provide the Administrator 30 days prior notice of the performance test to afford the Administrator the opportunity to have an observer present.[5]

(e) The owner or operator of an affected facility shall provide, or cause to be provided, performance testing facilities as follows:

(1) Sampling ports adequate for test methods applicable to such facility.

(2) Safe sampling platform(s).

(3) Safe access to sampling platform(s).

(4) Utilities for sampling and testing equipment.

(f) Each performance test shall consist of three separate runs using the applicable test method. Each run shall be conducted for the time and under the conditions specified in the applicable standard. For the purpose of determining compliance with an applicable standard, the arithmetic means of results of the three runs shall apply. In the event that a sample is accidentally lost or conditions occur in which one of the three runs must be discontinued because of forced shutdown, failure of an irreplaceable portion of the sample train, extreme meteorological conditions, or other circumstances, beyond the owner or operator's control, compliance may, upon the Administrator's approval, be determined using the arithmetic mean of the results of the two other runs.[5]

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).).[68]

§ 60.9 Availability of information.

The availability to the public of information provided to, or otherwise obtained by, the Administrator under this Part shall be governed by Part 2 of this chapter. (Information submitted voluntarily to the Administrator for the purposes of §§ 60.5 and 60.6 is governed by § 2.201 through § 2.213 of this chapter and not by § 2.301 of this chapter.)

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).).[68]

§ 60.10 State authority.

The provisions of this part shall not be construed in any manner to preclude any State or political subdivision thereof from:

(a) Adopting and enforcing any emission standard or limitation applicable to an affected facility, provided that such emission standard or limitation is not less stringent than the standard applicable to such facility.

(b) Requiring the owner or operator of an affected facility to obtain permits, licenses, or approvals prior to initiating construction, modification, or operation of such facility.

(Sec. 116 of the Clean Air Act as amended (42 U.S.C. 1857d-1).)[68]

§ 60.11 Compliance with standards and maintenance requirements.[4]

(a) Compliance with standards in this part, other than opacity standards, shall be determined only by performance tests established by § 60.8.

(b) Compliance with opacity standards in this part shall be determined by conducting observations in accordance with Reference Method 9 in Appendix A of this part or any alternative method that is approved by the Administrator. Opacity readings of portions of plumes which contain condensed, uncombined water vapor shall not be used for purposes of determining compliance with opacity standards. The results of continuous monitoring by transmissometer which indicate that the opacity at the time visual observations were made was not in excess of the standard are probative but not conclusive evidence of the actual opacity of an emission, provided that the source shall meet the burden of proving that the instrument used meets (at the time of the alleged violation) Performance Specification 1 in Appendix B of this part, has been properly maintained and (at the time of the alleged violation) calibrated, and that the resulting data have not been tampered with in any way. [10,60]

(c) The opacity standards set forth in this part shall apply at all times except during periods of startup, shutdown, malfunction, and as otherwise provided in the applicable standard.

(d) At all times, including periods of startup, shutdown, and malfunction, owners and operators shall, to the extent practicable, maintain and operate any affected facility including associated air pollution control equipment in a manner consistent with good air pollution control practice for minimizing emissions. Determination of whether acceptable operating and maintenance procedures are being used will be based on information available to the Administrator which may include, but is not limited to, monitoring results, opacity observations, review of operating and maintenance procedures, and inspection of the source.

(e) (1) An owner or operator of an affected facility may request the Administrator to determine opacity of emissions from the affected facility during the initial performance tests required by § 60.8.[10]

(2) Upon receipt from such owner or operator of the written report of the results of the performance tests required by § 60.8, the Administrator will make a finding concerning compliance with opacity and other applicable standards. If the Administrator finds that an affected facility is in compliance with all applicable standards for which performance tests are conducted in accordance with § 60.8 of this part but during the time such performance tests are being conducted fails to meet any applicable opacity standard, he shall notify the owner or operator and advise him that he may petition the Administrator within 10 days of receipt of notification to make appropriate adjustment to the opacity standard for the affected facility.[10]

(3) The Administrator will grant such a petition upon a demonstration by the owner or operator that the affected facility and associated air pollution control equipment was operated and maintained in a manner to minimize the opacity of emissions during the performance tests; that the performance tests were performed under the conditions established by the Administrator; and that the affected facility and associated air pollution control equipment were incapable of being adjusted or operated to meet the applicable opacity standard.[10]

(4) The Administrator will establish an opacity standard for the affected facility meeting the above requirements at a level at which the source will be able, as indicated by the performance and opacity tests, to meet the opacity standard at all times during which the source is meeting the mass or concentration emission standard. The Administrator will promulgate the new opacity standard in the Federal Register.[10]

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).).[68]

§ 60.12 Circumvention.[5]

No owner or operator subject to the provisions of this part shall build, erect, install, or use any article, machine, equipment or process, the use of which conceals an emission which would otherwise constitute a violation of an applicable standard. Such concealment includes, but is not limited to, the use of gaseous diluents to achieve compliance with an opacity standard or with a standard which is based on the concentration of a pollutant in the gases discharged to the atmosphere.

§ 60.13 Monitoring requirements.[18]

(a) Unless otherwise approved by the Administrator or specified in applicable subparts, the requirements of this section shall apply to all continuous monitoring systems required under applicable subparts.

(b) All continuous monitoring systems and monitoring devices shall be installed and operational prior to conducting performance tests under § 60.8. Verification of operational status shall, as a minimum, consist of the following:

(1) For continuous monitoring systems referenced in paragraph (c) (1) of this section, completion of the conditioning period specified by applicable requirements in Appendix B.

(2) For continuous monitoring systems referenced in paragraph (c) (2) of this section, completion of seven days of operation.

(3) For monitoring devices referenced in applicable subparts, completion of the manufacturer's written requirements or recommendations for checking the operation or calibration of the device.

(c) During any performance tests required under § 60.8 or within 30 days thereafter and at such other times as may be required by the Administrator under section 114 of the Act, the owner or operator of any affected facility shall conduct continuous monitoring system performance evaluations and furnish the Administrator within 60 days thereof two or, upon request, more copies of a written report of the results of such tests. These continuous monitoring system performance evaluations shall be conducted in accordance with the following specifications and procedures:

(1) Continuous monitoring systems listed within this paragraph except as provided in paragraph (c) (2) of this section shall be evaluated in accordance with the requirements and procedures contained in the applicable performance specification of Appendix B as follows:

(i) Continuous monitoring systems for measuring opacity of emissions shall comply with Performance Specification 1.

(ii) Continuous monitoring systems for measuring nitrogen oxides emissions shall comply with Performance Specification 2.

(iii) Continuous monitoring systems for measuring sulfur dioxide emissions shall comply with Performance Specification 2.

(iv) Continuous monitoring systems for measuring the oxygen content or carbon dioxide content of effluent gases shall comply with Performance Specification 3.

(2) An owner or operator who, prior to September 11, 1974, entered into a binding contractual obligation to purchase specific continuous monitoring system components except as referenced by paragraph (c) (2) (iii) of this section shall comply with the following requirements:

(i) Continuous monitoring systems for measuring opacity of emissions shall be capable of measuring emission levels within ±20 percent with a confidence level of 95 percent. The Calibration Error Test and associated calculation procedures set forth in Performance Specification 1 of Appendix B shall be used for demonstrating compliance with this specification.

(ii) Continuous monitoring systems for measurement of nitrogen oxides or sulfur dioxide shall be capable of measuring emission levels within ±20 percent with a confidence level of 95 percent. The Calibration Error Test, the Field Test for Accuracy (Relative), and associated operating and calculation procedures set forth in Performance Specification 2 of Appendix B shall be used for demonstrating compliance with this specification.

(iii) Owners or operators of all continuous monitoring systems installed on an affected facility prior to October 6, 1975 are not required to conduct tests under paragraphs (c) (2) (i) and/or (ii) of this section unless requested by the Administrator.[23]

(3) All continuous monitoring systems referenced by paragraph (c) (2) of this section shall be upgraded or replaced (if necessary) with new continuous monitoring systems, and the new or improved systems shall be demonstrated to comply with applicable performance specifications under paragraph (c) (1) of this section on or before September 11, 1979.[37]

(d) Owners or operators of all continuous monitoring systems installed in accordance with the provisions of this part shall check the zero and span drift at least once daily in accordance with the method prescribed by the manufacturer of such systems unless the manufacturer recommends adjustments at shorter intervals, in which case such recommendations shall be followed. The zero and span shall, as a minimum, be adjusted whenever the 24-hour zero drift or 24-hour calibration drift limits of the applicable performance specifications in Appendix B are exceeded. For continuous monitoring systems measuring opacity of emissions, the optical surfaces exposed to the effluent gases shall be cleaned prior to performing the zero or span drift adjustments except that for systems using automatic zero adjustments, the optical surfaces shall be cleaned when the cumulative automatic zero compensation exceeds four percent opacity. Unless otherwise approved by the Administrator, the following procedures, as applicable, shall be followed:

(1) For extractive continuous monitoring systems measuring gases, minimum procedures shall include introducing applicable zero and span gas mixtures into the measurement system as near the probe as is practical. Span and zero gases certified by their manufacturer to be traceable to National Bureau of Standards reference gases shall be used whenever these reference gases are available. The span and zero gas mixtures shall be the same composition as specified in Appendix B of this part. Every six months from date of manufacture, span and zero gases shall be reanalyzed by conducting triplicate analyses with Reference Methods 6 for SO_2, 7 for NO_x, and 3 for O_2 and CO_2, respectively. The gases may be analyzed at less frequent intervals if longer shelf lives are guaranteed by the manufacturer.

(2) For non-extractive continuous monitoring systems measuring gases, minimum procedures shall include upscale check(s) using a certified calibration gas cell or test cell which is functionally equivalent to a known gas concentration. The zero check may be performed by computing the zero value from upscale measurements or by mechanically producing a zero condition.

(3) For continuous monitoring systems measuring opacity of emissions, minimum procedures shall include a method for producing a simulated zero opacity condition and an upscale (span) opacity condition using a certified neutral density filter or other related technique to produce a known obscuration of the light beam. Such procedures shall provide a system check of the analyzer internal optical surfaces and all electronic circuitry including the lamp and photodetector assembly.

(e) Except for system breakdowns, repairs, calibration checks, and zero and span adjustments required under paragraph (d) of this section, all continuous monitoring systems shall be in continuous operation and shall meet minimum frequency of operation requirements as follows:

(1) All continuous monitoring systems referenced by paragraphs (c)(1) and (c)(2) of this section for measuring opacity of emissions shall complete a minimum of one cycle of sampling and analyzing for each successive ten-second period and one cycle of data recording for each successive six-minute period.[57]

(2) All continuous monitoring systems referenced by paragraph (c)(1) of this section for measuring oxides of nitrogen, sulfur dioxide, carbon dioxide, or oxygen shall complete a minimum of one cycle of operation (sampling, analyzing, and data recording) for each successive 15-minute period.

(3) All continuous monitoring systems referenced by paragraph (c)(2) of this section, except opacity, shall complete a minimum of one cycle of operation (sampling, analyzing, and data recording) for each successive one-hour period.

(f) All continuous monitoring systems or monitoring devices shall be installed such that representative measurements of emissions or process parameters from the affected facility are obtained. Additional procedures for [illegible]tion of continuous monitoring systems contained in the applicable Performance Specifications of Appendix B of this part shall be used.

(g) When the effluents from a single affected facility or two or more affected facilities subject to the same emission standards are combined before being released to the atmosphere, the owner or operator may install applicable continuous monitoring systems on each effluent or on the combined effluent. When the affected facilities are not subject to the same emission standards, separate continuous monitoring systems shall be installed on each effluent. When the effluent from one affected facility is released to the atmosphere through more than one point, the owner or operator shall install applicable continuous monitoring systems on each separate effluent unless the installation of fewer systems is approved by the Administrator.

(h) Owners or operators of all continuous monitoring systems for measurement of opacity shall reduce all data to six-minute averages and for systems other than opacity to one-hour averages for time periods under § 60.2 (x) and (r) respectively. Six-minute opacity averages shall be calculated from 24 or more data points equally spaced over each six-minute period. For systems other than opacity, one-hour averages shall be computed from four or more data points equally spaced over each one-hour period. Data recorded during periods of system breakdowns, repairs, calibration checks, and zero and span adjustments shall not be included in the data averages computed under this paragraph. An arithmetic or integrated average of all data may be used. The data output of all continuous monitoring systems may be recorded in reduced or nonreduced form (e.g. ppm pollutant and percent O_2 or lb/million Btu of pollutant). All excess emissions shall be converted into units of the standard using the applicable conversion procedures specified in subparts. After conversion into units of the standard, the data may be rounded to the same number of significant digits used in subparts to specify the applicable standard (e.g., rounded to the nearest one percent opacity).

(i) After receipt and consideration of written application, the Administrator may approve alternatives to any monitoring procedures or requirements of this part including, but not limited to the following:[42]

(1) Alternative monitoring requirements when installation of a continuous monitoring system or monitoring device specified by this part would not provide accurate measurements due to liquid water or other interferences caused by substances with the effluent gases.

(2) Alternative monitoring requirements when the affected facility is infrequently operated.

(3) Alternative monitoring requirements to accommodate continuous monitoring systems that require additional measurements to correct for stack moisture conditions.

(4) Alternative locations for installing continuous monitoring systems or monitoring devices when the owner or operator can demonstrate that installation at alternate locations will enable accurate and representative measurements.

(5) Alternative methods of converting pollutant concentration measurements to units of the standards.

(6) Alternative procedures for performing daily checks of zero and span drift that do not involve use of span gases or test cells.

(7) Alternatives to the A.S.T.M. test methods or sampling procedures specified by any subpart.

(8) Alternative continuous monitoring systems that do not meet the design or performance requirements in Performance Specification 1, Appendix B, but adequately demonstrate a definite and consistent relationship between its measurements and the measurements of opacity by a system complying with the requirements in Performance Specification 1. The Administrator may require that such demonstration be performed for each affected facility.

(9) Alternative monitoring requirements when the effluent from a single affected facility or the combined effluent from two or more affected facilities are released to the atmosphere through more than one point.

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).).[68]

§ 60.14 Modification.[22]

(a) Except as provided under paragraphs (d), (e) and (f) of this section, any physical or operational change to an existing facility which results in an increase in the emission rate to the atmosphere of any pollutant to which a standard applies shall be considered a modification within the meaning of section 111 of the Act. Upon modification, an existing facility shall become an affected facility for each pollutant to which a standard applies and for which there is an increase in the emission rate to the atmosphere.

(b) Emission rate shall be expressed as kg/hr of any pollutant discharged into the atmosphere for which a standard is applicable. The Administrator shall use the following to determine emission rate:

(1) Emission factors as specified in the latest issue of "Compilation of Air Pollutant Emission Factors," EPA Publication No. AP-42, or other emission factors determined by the Administrator to be superior to AP-42 emission factors, in cases where utilization of emission factors demonstrate that the emission level resulting from the physical or operational change will either clearly increase or clearly not increase.

(2) Material balances, continuous monitor data, or manual emission tests in cases where utilization of emission factors as referenced in paragraph (b)(1) of this section does not demonstrate to the Administrator's satisfaction whether the emission level resulting from the physical or operational change will either clearly increase or clearly not increase, or where an owner or operator demonstrates to the Administrator's satisfaction that there are reasonable grounds to dispute the result obtained by the Administrator utilizing emission factors as referenced in paragraph (b)(1) of this section. When the emission rate is based on results from manual emission tests or continuous monitoring systems, the procedures specified in Appendix C of this part shall be used to determine whether an increase in emission rate has occurred. Tests shall be conducted under such conditions as the Administrator shall specify to the owner or operator based on representative performance of the facility. At least three valid test runs must be conducted before and at least three after the physical or operational change. All operating parameters which may affect emissions must be held constant to the maximum feasible degree for all test runs.

(c) The addition of an affected facility to a stationary source as an expansion to that source or as a replacement for an existing facility shall not by itself bring within the applicability of this part any other facility within that source.

(d) A modification shall not be deemed to occur if an existing facility undergoes a physical or operational change where the owner or operator demonstrates to the Administrator's satisfaction (by any of the procedures prescribed under paragraph (b) of this section) that the total emission rate of any pollutant has not increased from all facilities within the stationary source to which appropriate reference, equivalent, or alternative methods, as defined in § 60.2 (s), (t) and (u), can be applied. An owner or operator may completely and permanently close any facility within a stationary source to prevent an increase in the total emission rate regardless of whether such reference, equivalent or alternative method can be applied, if the decrease in emission rate from such closure can be adequately determined by any of the procedures prescribed under paragraph (b) of this section. The owner or operator of the source shall have the burden of demonstrating compliance with this section.

(1) Such demonstration shall be in writing and shall include: (i) The name and address of the owner or operator.

(ii) The location of the stationary source.

(iii) A complete description of the existing facility undergoing the physical or operational change resulting in an increase in emission rate, any applicable control system, and the physical or operational change to such facility.

(iv) The emission rates into the atmosphere from the existing facility of each pollutant to which a standard applies determined before and after the physical or operational change takes place, to the extent such information is known or can be predicted.

(v) A complete description of each facility and the control systems, if any, for those facilities within the stationary source where the emission rate of each pollutant in question will be decreased to compensate for the increase in emission rate from the existing facility undergoing the physical or operational change.

(vi) The emission rates into the atmosphere of the pollutants in question from each facility described under paragraph (d)(1)(v) of this section both before and after the improvement or installation of any applicable control system or any physical or operational changes to such facilities to reduce emission rate.

(vii) A complete description of the procedures and methods used to determine the emission rates.

(2) Compliance with paragraph (d) of this section may be demonstrated by the methods listed in paragraph (b) of this section, where appropriate. Decreases in emissions resulting from requirements of a State implementation plan approved or promulgated under Part 52 of this chapter will not be acceptable. The required reduction in emission rate may be accomplished through the installation or improvement of a control system or through physical or operational changes to facilities including reducing the production of a facility or closing a facility.

(3) Emission rates established for the existing facility which is undergoing a physical or operational change resulting in an increase in the emission rate, and established for the facilities described under paragraph (d)(1)(v) of this section shall become the baseline for determining whether such facilities undergo a modification or are in compliance with standards.

(4) Any emission rate in excess of that rate established under paragraph (d)(3) of this section shall be a violation of these regulations except as otherwise provided in paragraph (e) of this section. However, any owner or operator electing to demonstrate compliance under this paragraph (d) must apply to the Administrator to obtain the use of any exemptions under paragraphs (e)(2), (e)(3), and (e)(4) of this section. The Administrator will grant such exemption only if, in his judgment, the compliance originally demonstrated under this paragraph will not be circumvented or nullified by the utilization of the exemption.

(5) The Administrator may require the use of continuous monitoring devices and compliance with necessary reporting procedures for each facility described in paragraph (d)(1)(iii) and (d)(1)(v) of this section.

(e) The following shall not, by themselves, be considered modifications under this part:

(1) Maintenance, repair, and replacement which the Administrator determines to be routine for a source category, subject to the provisions of paragraph (c) of this section and § 60.15.

(2) An increase in production rate of an existing facility, if that increase can be accomplished without a capital expenditure on the stationary source containing that facility.

(3) An increase in the hours of operation.

(4) Use of an alternative fuel or raw material if, prior to the date any standard under this part becomes applicable to that source type, as provided by § 60.1, the existing facility was designed to accommodate that alternative use. A facility shall be considered to be designed to accommodate an alternative fuel or raw material if that use could be accomplished under the facility's construction specifications as amended prior to the change. Conversion to coal required for energy considerations, as specified in section 119(d)(5) of the Act, shall not be considered a modification.

(5) The addition or use of any system or device whose primary function is the reduction of air pollutants, except when an emission control system is removed or is replaced by a system which the Administrator determines to be less environmentally beneficial.

(6) The relocation or change in ownership of an existing facility.

(f) Special provisions set forth under an applicable subpart of this part shall supersede any conflicting provisions of this section.

(g) Within 180 days of the completion of any physical or operational change subject to the control measures specified in paragraphs (a) or (d) of this section, compliance with all applicable standards must be achieved.

§ 60.15 Reconstruction.[22]

(a) An existing facility, upon reconstruction, becomes an affected facility, irrespective of any change in emission rate.

(b) "Reconstruction" means the replacement of components of an existing facility to such an extent that:

(1) The fixed capital cost of the new components exceeds 50 percent of the fixed capital cost that would be required to construct a comparable entirely new facility, and

(2) It is technologically and economically feasible to meet the applicable standards set forth in this part.

(c) "Fixed capital cost" means the capital needed to provide all the depreciable components.

(d) If an owner or operator of an existing facility proposes to replace components, and the fixed capital cost of the new components exceeds 50 percent of the fixed capital cost that would be required to construct a comparable entirely new facility, he shall notify the Administrator of the proposed replacements. The notice must be postmarked 60 days (or as soon as practicable) before construction of the replacements is commenced and must include the following information:

(1) Name and address of the owner or operator.

(2) The location of the existing facility.

(3) A brief description of the existing facility and the components which are to be replaced.

(4) A description of the existing air pollution control equipment and the proposed air pollution control equipment.

(5) An estimate of the fixed capital cost of the replacements and of constructing a comparable entirely new facility.

(6) The estimated life of the existing facility after the replacements.

(7) A discussion of any economic or technical limitations the facility may have in complying with the applicable standards of performance after the proposed replacements.

(e) The Administrator will determine, within 30 days of the receipt of the notice required by paragraph (d) of this section and any additional information he may reasonably require, whether the proposed replacement constitutes reconstruction.

(f) The Administrator's determination under paragraph (e) shall be based on:

(1) The fixed capital cost of the replacements in comparison to the fixed capital cost that would be required to construct a comparable entirely new facility;

(2) The estimated life of the facility after the replacements compared to the life of a comparable entirely new facility;

(3) The extent to which the components being replaced cause or contribute to the emissions from the facility; and

(4) Any economic or technical limitations on compliance with applicable standards of performance which are inherent in the proposed replacements.

(g) Individual subparts of this part may include specific provisions which refine and delimit the concept of reconstruction set forth in this section.

Subpart B—Adoption and Submittal of State Plans for Designated Facilities [21]

§ 60.20 Applicability.

The provisions of this subpart apply to States upon publication of a final guideline document under § 60.22(a).

§ 60.21 Definitions.

Terms used but not defined in this subpart shall have the meaning given them in the Act and in subpart A:

(a) "Designated pollutant" means any air pollutant, emissions of which are subject to a standard of performance for new stationary sources but for which air quality criteria have not been issued, and which is not included on a list published under section 108(a) or section 112(b)(1)(A) of the Act.

(b) "Designated facility" means any existing facility (see § 60.2(aa)) which emits a designated pollutant and which would be subject to a standard of performance for that pollutant if the existing facility were an affected facility (see § 60.2(e)).

(c) "Plan" means a plan under section 111(d) of the Act which establishes emission standards for designated pollutants from designated facilities and provides for the implementation and enforcement of such emission standards.

(d) "Applicable plan" means the plan, or most recent revision thereof, which has been approved under § 60.27(b) or promulgated under § 60.27(d).

(e) "Emission guideline" means a guideline set forth in subpart C of this part, or in a final guideline document published under § 60.22(a), which reflects the degree of emission reduction achievable through the application of the best system of emission reduction which (taking into account the cost of such reduction) the Administrator has determined has been adequately demonstrated for designated facilities.

(f) "Emission standard" means a legally enforceable regulation setting forth an allowable rate of emissions into the atmosphere, or prescribing equipment specifications for control of air pollution emissions.

(g) "Compliance schedule" means a legally enforceable schedule specifying a date or dates by which a source or category or sources must comply with specific emission standards contained in a plan or with any increments of progress to achieve such compliance.

(h) "Increments of progress" means steps to achieve compliance which must be taken by an owner or operator of a designated facility, including:

(1) Submittal of a final control plan for the designated facility to the appropriate air pollution control agency;

(2) Awarding of contracts for emission control systems or for process modifications, or issuance of orders for the purchase of component parts to accomplish emission control or process modification.

(3) Initiation of on-site construction or installation of emission control equipment or process change;

(4) Completion of on-site construction or installation of emission control equipment or process change; and

(5) Final compliance.

(i) "Region" means an air quality control region designated under section 107 of the Act and described in Part 81 of this chapter.

(j) "Local agency" means any local governmental agency.

§ 60.22 Publication of guideline documents, emission guidelines, and final compliance times.

(a) After promulgation of a standard of performance for the control of a designated pollutant from affected facilities, the Administrator will publish a draft guideline document containing information pertinent to control of the designated pollutant from designated facilities. Notice of the availability of the draft guideline document will be published in the Federal Register, and public comments on its contents will be invited. After consideration of public comments, a final guideline document will be published and notice of its availability will be published in the Federal Register.

(b) Guideline documents published under this section will provide information for the development of State plans, such as:

(1) Information concerning known or suspected endangerment of public health or welfare caused, or contributed to, by the designated pollutant.

(2) A description of systems of emission reduction which, in the judgment of the Administrator, have been adequately demonstrated.

(3) Information on the degree of emission reduction which is achievable with each system, together with information on the costs and environmental effects of applying each system to designated facilities.

(4) Incremental periods of time normally expected to be necessary for the design, installation, and startup of identified control systems.

(5) An emission guideline that reflects the application of the best system of emission reduction (considering the cost of such reduction) that has been adequately demonstrated for designated facilities, and the time within which compliance with emission standards of equivalent stringency can be achieved. The Administrator will specify different emission guidelines or compliance times or both for different sizes, types, and classes of designated facilities when costs of control, physical limitations, geographical location, or similar factors make subcategorization appropriate.

(6) Such other available information as the Administrator determines may contribute to the formulation of State plans.

(c) Except as provided in paragraph (d)(1) of this section, the emission guidelines and compliance times referred to in paragraph (b)(5) of this section will be proposed for comment upon publication of the draft guideline document, and after consideration of comments will be promulgated in Subpart C of this part with such modifications as may be appropriate.

(d)(1) If the Administrator determines that a designated pollutant may cause or contribute to endangerment of public welfare, but that adverse effects on public health have not been demonstrated, he will include the determination in the draft guideline document and in the Federal Register notice of its availability. Except as provided in paragraph (d)(2) of this section, paragraph (c) of this section shall be inapplicable in such cases.

(2) If the Administrator determines at any time on the basis of new information that a prior determination under paragraph (d)(1) of this section is incorrect or no longer correct, he will publish notice of the determination in the Federal Register, revise the guideline document as necessary under paragraph (a) of this section, and propose and promulgate emission guidelines and compliance times under paragraph (c) of this section.

§ 60.23 Adoption and submittal of State plans; public hearings.

(a)(1) Within nine months after notice of the availability of a final guideline document is published under § 60.22(a), each State shall adopt and submit to the Administrator, in accordance with § 60.4, a plan for the control of the designated pollutant to which the guideline document applies.

(2) Within nine months after notice of the availability of a final revised guideline document is published as provided in § 60.22(d)(2), each State shall adopt and submit to the Administrator any plan revision necessary to meet the requirements of this subpart.

(b) If no designated facility is located within a State, the State shall submit a letter of certification to that effect to the Administrator within the time specified in paragraph (a) of this section. Such certification shall exempt the State from the requirements of this subpart for that designated pollutant.

(c)(1) Except as provided in paragraphs (c)(2) and (c)(3) of this section, the State shall, prior to the adoption of any plan or revision thereof, conduct one or more public hearings within the State on such plan or plan revision.

(2) No hearing shall be required for any change to an increment of progress in an approved compliance schedule unless the change is likely to cause the facility to be unable to comply with the final compliance date in the schedule.

(3) No hearing shall be required on an emission standard in effect prior to the effective date of this subpart if it was adopted after a public hearing and is at least as stringent as the corresponding emission guideline specified in the applicable guideline document published under § 60.22(a).

(d) Any hearing required by paragraph (c) of this section shall be held only after reasonable notice. Notice shall be given at least 30 days prior to the date of such hearing and shall include:

(1) Notification to the public by prominently advertising the date, time, and place of such hearing in each region affected;

(2) Availability, at the time of public announcement, of each proposed plan or

revision thereof for public inspection in at least one location in each region to which it will apply;

(3) Notification to the Administrator;

(4) Notification to each local air pollution control agency in each region to which the plan or revision will apply; and

(5) In the case of an interstate region, notification to any other State included in the region.

(e) The State shall prepare and retain, for a minimum of 2 years, a record of each hearing for inspection by any interested party. The record shall contain, as a minimum, a list of witnesses together with the text of each presentation.

(f) The State shall submit with the plan or revision:

(1) Certification that each hearing required by paragraph (c) of this section was held in accordance with the notice required by paragraph (d) of this section; and

(2) A list of witnesses and their organizational affiliations, if any, appearing at the hearing and a brief written summary of each presentation or written submission.

(g) Upon written application by a State agency (through the appropriate Regional Office), the Administrator may approve State procedures designed to insure public participation in the matters for which hearings are required and public notification of the opportunity to participate if, in the judgment of the Administrator, the procedures, although different from the requirements of this subpart, in fact provide for adequate notice to and participation of the public. The Administrator may impose such conditions on his approval as he deems necessary. Procedures approved under this section shall be deemed to satisfy the requirements of this subpart regarding procedures for public hearings.

§ 60.24 Emission standards and compliance schedules.

(a) Each plan shall include emission standards and compliance schedules.

(b)(1) Emission standards shall prescribe allowable rates of emissions except when it is clearly impracticable. Such cases will be identified in the guideline documents issued under § 60.22. Where emission standards prescribing equipment specifications are established, the plan shall, to the degree possible, set forth the emission reductions achievable by implementation of such specifications, and may permit compliance by the use of equipment determined by the State to be equivalent to that prescribed.

(2) Test methods and procedures for determining compliance with the emission standards shall be specified in the plan. Methods other than those specified in Appendix A to this part may be specified in the plan if shown to be equivalent or alternative methods as defined in § 60.2 (t) and (u).

(3) Emission standards shall apply to all designated facilities within the State. A plan may contain emission standards adopted by local jurisdictions provided that the standards are enforceable by the State.

(c) Except as provided in paragraph (f) of this section, where the Administrator has determined that a designated pollutant may cause or contribute to endangerment of public health, emission standards shall be no less stringent than the corresponding emission guideline(s) specified in subpart C of this part, and final compliance shall be required as expeditiously as practicable but no later than the compliance times specified in Subpart C.

(d) Where the Administrator has determined that a designated pollutant may cause or contribute to endangerment of public welfare but that adverse effects on public health have not been demonstrated, States may balance the emission guidelines, compliance times, and other information provided in the applicable guideline document against other factors of public concern in establishing emission standards, compliance schedules, and variances. Appropriate consideration shall be given to the factors specified in § 60.22(b) and to information presented at the public hearing(s) conducted under § 60.23(c).

(e) (1) Any compliance schedule extending more than 12 months from the date required for submittal of the plan shall include legally enforceable increments of progress to achieve compliance for each designated facility or category of facilities. Increments of progress shall include, where practicable, each increment of progress specified in § 60.21(h) and shall include such additional increments of progress as may be necessary to permit close and effective supervision of progress toward final compliance.

(2) A plan may provide that compliance schedules for individual sources or categories of sources will be formulated after plan submittal. Any such schedule shall be the subject of a public hearing held according to § 60.23 and shall be submitted to the Administrator within 60 days after the date of adoption of the schedule but in no case later than the date prescribed for submittal of the first semiannual report required by § 60.25(e).

(f) On a case-by-case basis for particular designated facilities, or classes of facilities, States may provide for the application of less stringent emission standards or longer compliance schedules than those otherwise required by paragraph (c) of this section, provided that the State demonstrates with respect to each such facility (or class of facilities):

(1) Unreasonable cost of control resulting from plant age, location, or basic process design;

(2) Physical impossibility of installing necessary control equipment; or

(3) Other factors specific to the facility (or class of facilities) that make application of a less stringent standard or final compliance time significantly more reasonable.

(g) Nothing in this subpart shall be construed to preclude any State or political subdivision thereof from adopting or enforcing (1) emission standards more stringent than emission guidelines specified in subpart C of this part or in applicable guideline documents or (2) compliance schedules requiring final compliance at earlier times than those specified in subpart C or in applicable guideline documents.

(Sec. 116 of the Clean Air Act as amended (42 U.S.C. 1857d-1).)[68]

§ 60.25 Emission inventories, source surveillance, reports.

(a) Each plan shall include an inventory of all designated facilities, including emission data for the designated pollutants and information related to emissions as specified in Appendix D to this part. Such data shall be summarized in the plan, and emission rates of designated pollutants from designated facilities shall be correlated with applicable emission standards. As used in this subpart, "correlated" means presented in such a manner as to show the relationship between measured or estimated amounts of emissions and the amounts of such emissions allowable under applicable emission standards.

(b) Each plan shall provide for monitoring the status of compliance with applicable emission standards. Each plan shall, as a minimum, provide for:

(1) Legally enforceable procedures for requiring owners or operators of designated facilities to maintain records and periodically report to the State information on the nature and amount of emissions from such facilities, and/or such other information as may be necessary to enable the State to determine whether such facilities are in compliance with applicable portions of the plan.

(2) Periodic inspection and, when applicable, testing of designated facilities.

(c) Each plan shall provide that information obtained by the State under paragraph (b) of this section shall be correlated with applicable emission standards (see § 60.25(a)) and made available to the general public.

(d) The provisions referred to in paragraphs (b) and (c) of this section shall be specifically identified. Copies of such provisions shall be submitted with the plan unless:

(1) They have been approved as portions of a preceding plan submitted under this subpart or as portions of an implementation plan submitted under section 110 of the Act, and

(2) The State demonstrates:

(i) That the provisions are applicable to the designated pollutant(s) for which the plan is submitted, and

(ii) That the requirements of § 60.26 are met.

(e) The State shall submit reports on progress in plan enforcement to the Administrator on a semiannual basis, commencing with the first full report period after approval of a plan or after promulgation of a plan by the Administrator. The semiannual periods are January 1–June 30 and July 1–December 31. Information required under this paragraph shall be included in the semiannual reports required by § 51.7 of this chapter.

(f) Each progress report shall include:

(1) Enforcement actions initiated against designated facilities during the reporting period, under any emission

standard or compliance schedule of the plan.

(2) Identification of the achievement of any increment of progress required by the applicable plan during the reporting period.

(3) Identification of designated facilities that have ceased operation during the reporting period.

(4) Submission of emission inventory data as described in paragraph (a) of this section for designated facilities that were not in operation at the time of plan development but began operation during the reporting period.

(5) Submission of additional data as necessary to update the information submitted under paragraph (a) of this section or in previous progress reports.

(6) Submission of copies of technical reports on all performance testing on designated facilities conducted under paragraph (b)(2) of this section, complete with concurrently recorded process data.

§ 60.26 Legal authority.

(a) Each plan shall show that the State has legal authority to carry out the plan, including authority to:

(1) Adopt emission standards and compliance schedules applicable to designated facilities.

(2) Enforce applicable laws, regulations, standards, and compliance schedules, and seek injunctive relief.

(3) Obtain information necessary to determine whether designated facilities are in compliance with applicable laws, regulations, standards, and compliance schedules, including authority to require recordkeeping and to make inspections and conduct tests of designated facilities.

(4) Require owners or operators of designated facilities to install, maintain, and use emission monitoring devices and to make periodic reports to the State on the nature and amounts of emissions from such facilities; also authority for the State to make such data available to the public as reported and as correlated with applicable emission standards.

(b) The provisions of law or regulations which the State determines provide the authorities required by this section shall be specifically identified. Copies of such laws or regulations shall be submitted with the plan unless:

(1) They have been approved as portions of a preceding plan submitted under this subpart or as portions of an implementation plan submitted under section 110 of the Act, and

(2) The State demonstrates that the laws or regulations are applicable to the designated pollutant(s) for which the plan is submitted.

(c) The plan shall show that the legal authorities specified in this section are available to the State at the time of submission of the plan. Legal authority adequate to meet the requirements of paragraphs (a)(3) and (4) of this section may be delegated to the State under section 114 of the Act.

(d) A State governmental agency other than the State air pollution control agency may be assigned responsibility for carrying out a portion of a plan if the plan demonstrates to the Administrator's satisfaction that the State governmental agency has the legal authority necessary to carry out that portion of the plan.

(e) The State may authorize a local agency to carry out a plan, or portion thereof, within the local agency's jurisdiction if the plan demonstrates to the Administrator's satisfaction that the local agency has the legal authority necessary to implement the plan or portion thereof, and that the authorization does not relieve the State of responsibility under the Act for carrying out the plan or portion thereof.

§ 60.27 Actions by the Administrator.

(a) The Administrator may, whenever he determines necessary, extend the period for submission of any plan or plan revision or portion thereof.

(b) After receipt of a plan or plan revision, the Administrator will propose the plan or revision for approval or disapproval. The Administrator will, within four months after the date required for submission of a plan or plan revision, approve or disapprove such plan or revision or each portion thereof.

(c) The Administrator will, after consideration of any State hearing record, promptly prepare and publish proposed regulations setting forth a plan, or portion thereof, for a State if:

(1) The State fails to submit a plan within the time prescribed;

(2) The State fails to submit a plan revision required by § 60.23(a)(2) within the time prescribed; or

(3) The Administrator disapproves the State plan or plan revision or any portion thereof, as unsatisfactory because the requirements of this subpart have not been met.

(d) The Administrator will, within six months after the date required for submission of a plan or plan revision, promulgate the regulations proposed under paragraph (c) of this section with such modifications as may be appropriate unless, prior to such promulgation, the State has adopted and submitted a plan or plan revision which the Administrator determines to be approvable.

(e)(1) Except as provided in paragraph (e)(2) of this section, regulations proposed and promulgated by the Administrator under this section will prescribe emission standards of the same stringency as the corresponding emission guideline(s) specified in the final guideline document published under § 60.22(a) and will require final compliance with such standards as expeditiously as practicable but no later than the times specified in the guideline document.

(2) Upon application by the owner or operator of a designated facility to which regulations proposed and promulgated under this section will apply, the Administrator may provide for the application of less stringent emission standards or longer compliance schedules than those otherwise required by this section in accordance with the criteria specified in § 60.24(f).

(f) If a State failed to hold a public hearing as required by § 60.23(c), the Administrator will provide opportunity for a hearing within the State prior to promulgation of a plan under paragraph (d) of this section.

§ 60.28 Plan revisions by the State.

(a) Plan revisions which have the effect of delaying compliance with applicable emission standards or increments of progress or of establishing less stringent emission standards shall be submitted to the Administrator within 60 days after adoption in accordance with the procedures and requirements applicable to development and submission of the original plan.

(b) More stringent emission standards, or orders which have the effect of accelerating compliance, may be submitted to the Administrator as plan revisions in accordance with the procedures and requirements applicable to development and submission of the original plan.

(c) A revision of a plan, or any portion thereof, shall not be considered part of an applicable plan until approved by the Administrator in accordance with this subpart.

§ 60.29 Plan revisions by the Administrator.

After notice and opportunity for public hearing in each affected State, the Administrator may revise any provision of an applicable plan if:

(a) The provision was promulgated by the Administrator, and

(b) The plan, as revised, will be consistent with the Act and with the requirements of this subpart.

Subpart C—Emission Guidelines and Compliance Times

[Reserved]

Subpart D—Standards of Performance for Fossil-Fuel Fired Steam Generators

§ 60.40 Applicability and designation of affected facility.[8,49,64]

(a) The affected facilities to which the provisions of this subpart apply are:

(1) Each fossil-fuel-fired steam generating unit of more than 73 megawatts heat input rate (250 million Btu per hour).

(2) Each fossil-fuel and wood-residue-fired steam generating unit capable of firing fossil fuel at a heat input rate of more than 73 megawatts (250 million Btu per hour).

(b) Any change to an existing fossil-fuel-fired steam generating unit to accommodate the use of combustible materials, other than fossil fuels as defined in this subpart, shall not bring that unit under the applicability of this subpart.

(c) Any facility under paragraph (a) of this section that commences construction or modification after August 17, 1971, is subject to the requirements of this subpart.

§ 60.41 Definitions.[8]

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act, and in subpart A of this part.

(a) "Fossil fuel-fired steam generating unit" means a furnace or boiler used in the process of burning fossil fuel for the purpose of producing steam by heat transfer.

(b) "Fossil fuel" means natural gas, petroleum, coal, and any form of solid, liquid, or gaseous fuel derived from such materials for the purpose of creating useful heat.

(c) "Coal refuse" means waste-products of coal mining, cleaning, and coal preparation operations (e.g. culm, gob, etc.) containing coal, matrix material, clay, and other organic and inorganic material.[11]

(d) "Fossil fuel and wood residue-fired steam generating unit" means a furnace or boiler used in the process of burning fossil fuel and wood residue for the purpose of producing steam by heat transfer.[20]

(e) "Wood residue" means bark, sawdust, slabs, chips, shavings, mill trim, and other wood products derived from wood processing and forest management operations.[49]

§ 60.42 Standard for particulate matter.[8]

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility any gases which:

(1) Contain particulate matter in excess of 43 nanograms per joule heat input (0.10 lb per million Btu) derived from fossil fuel or fossil fuel and wood residue.[49]

(2) Exhibit greater than 20 percent opacity except that a maximum of 40 percent opacity shall be permissible for not more than 2 minutes in any hour.[18]

§ 60.43 Standard for sulfur dioxide.[7,8]

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility any gases which contain sulfur dioxide in excess of:

(1) 340 nanograms per joule heat input (0.80 lb per million Btu) derived from liquid fossil fuel or liquid fossil fuel and wood residue.[49]

(2) 520 nanograms per joule heat input (1.2 lb per million Btu) derived from solid fossil fuel or solid fossil fuel and wood residue.[49]

(b) When different fossil fuels are burned simultaneously in any combination, the applicable standard (in ng/J) shall be determined by proration using the following formula:

$$PS_{SO_2}=\frac{y(340)+z(520)}{y+z}$$

where:

PS_{SO_2} is the prorated standard for sulfur dioxide when burning different fuels simultaneously, in nanograms per joule heat input derived from all fossil fuels fired or from all fossil fuels and wood residue fired,

y is the percentage of total heat input derived from liquid fossil fuel, and

z is the percentage of total heat input derived from solid fossil fuel.[49]

(c) Compliance shall be based on the total heat input from all fossil fuels burned, including gaseous fuels.

§ 60.44 Standard for nitrogen oxides.[8]

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility any gases which contain nitrogen oxides, expressed as NO_2 in excess of:

(1) 86 nanograms per joule heat input (0.20 lb per million Btu) derived from gaseous fossil fuel or gaseous fossil fuel and wood residue.[49]

(2) 130 nanograms per joule heat input (0.30 lb per million Btu) derived from liquid fossil fuel or liquid fossil fuel and wood residue.[49]

(3) 300 nanograms per joule heat input (0.70 lb per million Btu) derived from solid fossil fuel or solid fossil fuel and wood residue (except lignite or a solid fossil fuel containing 25 percent, by weight, or more of coal refuse).[11,49]

(b) When different fossil fuels are burned simultaneously in any combination, the applicable standards (in ng/J) shall be determined by proration. Compliance shall be determined by using the following formula:

$$PS_{NO_x}=\frac{x(86)+y(130)+z(300)}{x+y+z}$$

where:

PS_{NO_x} is the prorated standard for nitrogen oxides when burning different fuels simultaneously, in nanograms per joule heat input derived from all fossil fuels fired or from all fossil fuels and wood residue fired,

x is the percentage of total heat input derived from gaseous fossil fuel,

y is the percentage of total heat input derived from liquid fossil fuel, and

z is the percentage of total heat input derived from solid fossil fuel (except lignite or a solid fossil fuel containing 25 percent, by weight, or more of coal refuse).[49]

When lignite or a solid fossil fuel containing 25 percent, by weight, or more of coal refuse is burned in combination with gaseous, liquid, other solid fossil fuel, or wood residue, the standard for nitrogen oxides does not apply.[11,49]

§ 60.45 Emission and fuel monitoring.[4,8,18]

(a) Each owner or operator shall install, calibrate, maintain, and operate continuous monitoring systems for measuring the opacity of emissions, sulfur dioxide emissions, nitrogen oxides emissions, and either oxygen or carbon dioxide except as provided in paragraph (b) of this section.[57]

(b) Certain of the continuous monitoring system requirements under paragraph (a) of this section do not apply to owners or operators under the following conditions:[57]

(1) For a fossil fuel-fired steam generator that burns only gaseous fossil fuel, continuous monitoring systems for measuring the opacity of emissions and sulfur dioxide emissions are not required.[57]

(2) For a fossil fuel-fired steam generator that does not use a flue gas desulfurization device, a continuous monitoring system for measuring sulfur dioxide emissions is not required if the owner or operator monitors sulfur dioxide emissions by fuel sampling and analysis under paragraph (d) of this section.[57]

(3) Notwithstanding § 60.13(b), installation of a continuous monitoring system for nitrogen oxides may be delayed until after the initial performance tests under § 60.8 have been conducted. If the owner or operator demonstrates during the performance test that emissions of nitrogen oxides are less than 70 percent of the applicable standards in § 60.44, a continuous monitoring system for measuring nitrogen oxides emissions is not required. If the initial performance test results show that nitrogen oxide emissions are greater than 70 percent of the applicable standard, the owner or operator shall install a continuous monitoring system for nitrogen oxides within one year after the date of the initial performance tests under § 60.8 and comply

with all other applicable monitoring requirements under this part.[57]

(4) If an owner or operator does not install any continuous monitoring systems for sulfur oxides and nitrogen oxides, as provided under paragraphs (b)(1) and (b)(3) or paragraphs (b)(2) and (b)(3) of this section a continuous monitoring system for measuring either oxygen or carbon dioxide is not required.[57]

(c) For performance evaluations under § 60.13(c) and calibration checks under § 60.13(d), the following procedures shall be used:[57]

(1) Reference Methods 6 or 7, as applicable, shall be used for conducting performance evaluations of sulfur dioxide and nitrogen oxides continuous monitoring systems.[57]

(2) Sulfur dioxide or nitric oxide, as applicable, shall be used for preparing calibration gas mixtures under Performance Specification 2 of Appendix B to this part.[57]

(3) For affected facilities burning fossil fuel(s), the span value for a continuous monitoring system measuring the opacity of emissions shall be 80, 90, or 100 percent and for a continuous monitoring system measuring sulfur oxides or nitrogen oxides the span value shall be determined as follows:

[In parts per million]

Fossil fuel	Span value for sulfur dioxide	Span value for nitrogen oxides
Gas	(1)	500
Liquid	1,000	500
Solid	1,500	500
Combinations	$1,000y+1,500z$	$500(x+y)+1,000z$

[1] Not applicable.

where:

x = the fraction of total heat input derived from gaseous fossil fuel, and

y = the fraction of total heat input derived from liquid fossil fuel, and

z = the fraction of total heat input derived from solid fossil fuel.[57]

(4) All span values computed under paragraph (c)(3) of this section for burning combinations of fossil fuels shall be rounded to the nearest 500 ppm.[57]

(5) For a fossil fuel-fired steam generator that simultaneously burns fossil fuel and nonfossil fuel, the span value of all continuous monitoring systems shall be subject to the Administrator's approval.[57]

(d) [Reserved][57]

(e) For any continuous monitoring system installed under paragraph (a) of this section, the following conversion procedures shall be used to convert the continuous monitoring data into units of the applicable standards (ng/J, lb/million Btu):[49, 57]

(1) When a continuous monitoring system for measuring oxygen is selected, the measurement of the pollutant concentration and oxygen concentration shall each be on a consistent basis (wet or dry). Alternative procedures approved by the Administrator shall be used when measurements are on a wet basis. When measurements are on a dry basis, the following conversion procedure shall be used:

$$E = CF\left[\frac{20.9}{20.9-\text{percent } O_2}\right]$$

where:

E, C, F, and $\%O_2$ are determined under paragraph (f) of this section.[57]

(2) When a continuous monitoring system for measuring carbon dioxide is selected, the measurement of the pollutant concentration and carbon dioxide concentration shall each be on a consistent basis (wet or dry) and the following conversion procedure shall be used:

$$E = CF_c\left[\frac{100}{\text{percent } CO_2}\right]$$

where:

E, C, F_c and $\%CO_2$ are determined under paragraph (f) of this section.[57]

(f) The values used in the equations under paragraphs (e)(1) and (2) of this section are derived as follows:

(1) E = pollutant emissions, ng/J (lb/million Btu).

(2) C = pollutant concentration, ng/dscm (lb/dscf), determined by multiplying the average concentration (ppm) for each one-hour period by 4.15×10^4 M ng/dscm per ppm (2.59×10^{-9} M lb/dscf per ppm) where M = pollutant molecular weight, g/g-mole (lb/lb-mole). M = 64.07 for sulfur dioxide and 46.01 for nitrogen oxides.[49]

(3) $\%O_2$, $\%CO_2$ = oxygen or carbon dioxide volume (expressed as percent), determined with equipment specified under paragraph (d) of this section.

(4) F, F_c = a factor representing a ratio of the volume of dry flue gases generated to the calorific value of the fuel combusted (F), and a factor representing a ratio of the volume of carbon dioxide generated to the calorific value of of the fuel combusted (F_c), respectively. Values of F and F_c are given as follows:

(i) For anthracite coal as classified according to A.S.T.M. D 388-66, $F = 2.723\times10^{-7}$ dscm/J (10,140 dscf/million Btu) and $F_c = 0.532\times10^{-7}$ scm CO_2/J (1,980 scf CO_2/million Btu).[49]

(ii) For subbituminous and bituminous coal as classified according to A.S.T.M. D 388-66, $F = 2.637\times10^{-7}$ dscm/J (9,820 dscf/million Btu) and $F_c = 0.486\times10^{-7}$ scm CO_2/J (1,810 scf CO_2/million Btu).[49]

(iii) For liquid fossil fuels including crude, residual, and distillate oils, $F = 2.476\times10^{-7}$ dscm/J (9,220 dscf/million Btu) and $F_c = 0.384\times10^{-7}$ scm CO_2/J (1,430 scf CO_2/million Btu).[49, 67]

(iv) For gaseous fossil fuels, $F = 2.347\times10^{-7}$ dscm/J (8,740 dscf/million Btu). For natural gas, propane, and butane fuels, $F_c = 0.279\times10^{-7}$ scm CO_2/J (1,040 scf CO_2/million Btu) for natural gas, 0.322×10^{-7} scm CO_2/J (1,200 scf CO_2/million Btu) for propane, and 0.338×10^{-7} scm CO_2/J (1,260 scf CO_2/million Btu) for butane.[49, 67]

(v) For bark $F = 2.589\times10^{-7}$ dscm/J (9,640 dscf/million Btu) and $F_c = 0.500\times10^{-7}$ scm CO_2/J (1,860 scf CO_2/million Btu). For wood residue other than bark $F = 2.492\times10^{-7}$ dscm/J (9,280 dscf/million Btu) and $F_c = 0.494\times10^{-7}$ scm CO_2/J (1,840 scf CO_2/million Btu).[49, 67]

(5) The owner or operator may use the following equation to determine an F factor (dscm/J or dscf/million Btu) on a dry basis (if it is desired to calculate F on a wet basis, consult the Administrator) or F_c factor (scm CO_2/J, or scf CO_2/million Btu) on either basis in lieu of the F or F_c factors specified in paragraph (f)(4) of this section:[49]

$$F = 10^{-6}\frac{[227.2\,(\text{pct. H}) + 95.5\,(\text{pct. C}) + 35.6\,(\text{pct. S}) + 8.7\,(\text{pct. N}) - 28.7\,(\text{pct. O})]}{\text{GCV}}.$$

(SI units)

$$F = \frac{10^6[3.64(\%H) + 1.53(\%C) + 0.57(\%S) + 0.14(\%N) -- 0.46(\%O)]}{GCV}$$

(English units)

$$F_c = \frac{2.0\times10^{-5}\,(\text{pct. C})}{\text{GCV}}.$$

(SI units)

$$F_c = \frac{321\times10^3(\%C)}{GCV}$$

[23, 49, 67]

(English units)

(i) H, C, S, N, and O are content by weight of hydrogen, carbon, sulfur, nitrogen, and oxygen (expressed as percent), respectively, as determined on the same basis as GCV by ultimate analysis of the fuel fired, using A.S.T.M. method D3178-74 or D3176 (solid fuels), or computed from results using A.S.T.M. methods D1137-53(70), D1945-64(73), or D1946-67(72) (gaseous fuels) as applicable.

(ii) GCV is the gross calorific value (kJ/kg, Btu/lb) of the fuel combusted, determined by the A.S.T.M. test methods D 2015–66(72) for solid fuels and D 1826–64(70) for gaseous fuels as applicable.[49]

(iii) For affected facilities which fire both fossil fuels and nonfossil fuels, the F or F_c value shall be subject to the Administrator's approval.[49]

(6) For affected facilities firing combinations of fossil fuels or fossil fuels and wood residue, the F or F_c factors determined by paragraphs (f)(4) or (f)(5) of this section shall be prorated in accordance with the applicable formula as follows:

$$F=\sum_{i=1}^{n} X_i F_i \text{ or } F_c=\sum_{i=1}^{n} X_i (F_c)_i$$

where:

X_i = the fraction of total heat input derived from each type of fuel (e.g. natural gas, bituminous coal, wood residue, etc.)

F_i or $(F_c)_i$ = the applicable F or F_c factor for each fuel type determined in accordance with paragraphs (f)(4) and (f)(5) of this section.

n = the number of fuels being burned in combination.[49]

(g) For the purpose of reports required under § 60.7(c), periods of excess emissions that shall be reported are defined as follows:

(1) [Reserved]

(2) Sulfur dioxide. Excess emissions for affected facilities are defined as:

(i) Any three-hour period during which the average emissions (arithmetic average of three contiguous one-hour periods) of sulfur dioxide as measured by a continuous monitoring system exceed the applicable standard under § 60.43.

(ii) [Reserved]

(3) Nitrogen oxides. Excess emissions for affected facilities using a continuous monitoring system for measuring nitrogen oxides are defined as any three-hour period during which the average emissions (arithmetic average of three contiguous one-hour periods) exceed the applicable standards under § 60.44.

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).). 68

§ 60.46 Test methods and procedures.[8,18]

(a) The reference methods in Appendix A of this part, except as provided in § 60.8(b), shall be used to determine compliance with the standards as prescribed in §§ 60.42, 60.43, and 60.44 as follows:

(1) Method 1 for selection of sampling site and sample traverses.

(2) Method 3 for gas analysis to be used when applying Reference Methods 5, 6 and 7.

(3) Method 5 for concentration of particulate matter and the associated moisture content.

(4) Method 6 for concentration of SO_2, and

(5) Method 7 for concentration of NOx.

(b) For Method 5, Method 1 shall be used to select the sampling site and the number of traverse sampling points. The sampling time for each run shall be at least 60 minutes and the minimum sampling volume shall be 0.85 dscm (30 dscf) except that smaller sampling times or volumes, when necessitated by process variables or other factors, may be approved by the Administrator. The probe and filter holder heating systems in the sampling train shall be set to provide a gas temperature no greater than 433 °K (320°F).[49]

(c) For Methods 6 and 7, the sampling site shall be the same as that selected for Method 5. The sampling point in the duct shall be at the centroid of the cross section or at a point no closer to the walls than 1 m (3.28 ft). For Method 6, the sample shall be extracted at a rate proportional to the gas velocity at the sampling point.

(d) For Method 6, the minimum sampling time shall be 20 minutes and the minimum sampling volume 0.02 dscm (0.71 dscf) for each sample. The arithmetic mean of two samples shall constitute one run. Samples shall be taken at approximately 30-minute intervals.

(e) For Method 7, each run shall consist of at least four grab samples taken at approximately 15-minute intervals. The arithmetic mean of the samples shall constitute the run value.

(f) For each run using the methods specified by paragraphs (a)(3), (a)(4), and (a)(5) of this section, the emissions expressed in ng/J (lb/million Btu) shall be determined by the following procedure:

$$E=CF\frac{20.9}{20.9-\text{percent } O_2}$$

where:

(1) E = pollutant emission ng/J (lb/million Btu).

(2) C = pollutant concentration, ng/dscm (lb/dscf), determined by method 5, 6, or 7.

(3) Percent O_2 = oxygen content by volume (expressed as percent), dry basis. Percent oxygen shall be determined by using the integrated or grab sampling and analysis procedures of Method 3 as applicable.[49]

The sample shall be obtained as follows:

(i) For determination of sulfur dioxide and nitrogen oxides emissions, the oxygen sample shall be obtained simultaneously at the same point in the duct as used to obtain the samples for Methods 6 and 7 determinations, respectively [§ 60.46(c)]. For Method 7, the oxygen sample shall be obtained using the grab sampling and analysis procedures of Method 3.

(ii) For determination of particulate emissions, the oxygen sample shall be obtained simultaneously by traversing the duct at the same sampling location used for each run of Method 5 under paragraph (b) of this section. Method 1 shall be used for selection of the number of traverse points except that no more than 12 sample points are required.

(4) F = a factor as determined in paragraphs (f)(4), (5) or (6) of § 60.45.

(g) When combinations of fossil fuels or fossil fuel and wood residue are fired, the heat input, expressed in watts (Btu/hr), is determined during each testing period by multiplying the gross calorific value of each fuel fired (in J/kg or Btu/lb) by the rate of each fuel burned (in kg/sec or lb/hr). Gross calorific values are determined in accordance with A.S.T.M. methods D 2015–66(72) (solid fuels), D 240–64(73) (liquid fuels), or D 1826–64(7) (gaseous fuels) as applicable. The method used to determine calorific value of wood residue must be approved by the Administrator. The owner or operator shall determine the rate of fuels burned during each testing period by suitable methods and shall confirm the rate by a material balance over the steam generation system.[49]

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).). 68

36 FR 24876, 12/23/71 (1)
as amended
37 FR 14877, 7/26/72 (2)
38 FR 28564, 10/15/73 (4)
39 FR 20790, 6/14/74 (8)
40 FR 2803, 1/16/75 (11)
40 FR 46250, 10/6/75 (18)
40 FR 59204, 12/22/75 (23)
41 FR 51397, 11/22/76 (49)
42 FR 5936, 1/31/77 (57)
42 FR 37936, 7/25/77 (64)
42 FR 41122, 8/15/77 (67)
42 FR 41424, 8/17/77 (68)

Subpart E—Standards of Performance for Incinerators

§ 60.50 Applicability and designation of affected facility.[8, 64]

(a) The provisions of this subpart are applicable to each incinerator of more than 45 metric tons per day charging rate (50 tons/day), which is the affected facility.

(b) Any facility under paragraph (a) of this section that commences construction or modification after August 17, 1971, is subject to the requirements of this subpart.

§ 60.51 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in Subpart A of this part.

(a) "Incinerator" means any furnace used in the process of burning solid waste for the purpose of reducing the volume of the waste by removing combustible matter.[8]

(b) "Solid waste" means refuse, more than 50 percent of which is municipal type waste consisting of a mixture of paper, wood, yard wastes, food wastes, plastics, leather, rubber, and other combustibles, and noncombustible materials such as glass and rock.

(c) "Day" means 24 hours.[8]

§ 60.52 Standard for particulate matter.[8]

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this part shall cause to be discharged into the atmosphere from any affected facility any gases which contain particulate matter in excess of 0.18 g/dscm (0.08 gr/dscf) corrected to 12 percent CO_2.

§ 60.53 Monitoring of operations.[8]

(a) The owner or operator of any incinerator subject to the provisions of this part shall record the daily charging rates and hours of operation.

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).).[68]

§ 60.54 Test methods and procedures.[8]

(a) The reference methods in Appendix A to this part, except as provided for in § 60.8(b), shall be used to determine compliance with the standard prescribed in § 60.52 as follows:

(1) Method 5 for the concentration of particulate matter and the associated moisture content;

(2) Method 1 for sample and velocity traverses;

(3) Method 2 for velocity and volumetric flow rate; and

(4) Method 3 for gas analysis and calculation of excess air, using the integrated sample technique.

(b) For Method 5, the sampling time for each run shall be at least 60 minutes and the minimum sample volume shall be 0.85 dscm (30.0 dscf) except that smaller sampling times or sample volumes, when necessitated by process variables or other factors, may be approved by the Administrator.

(c) If a wet scrubber is used, the gas analysis sample shall reflect flue gas conditions after the scrubber, allowing for carbon dioxide absorption by sampling the gas on the scrubber inlet and outlet sides according to either the procedure under paragraphs (c)(1) through (c)(5) of this section or the procedure under paragraphs (c)(1), (c)(2) and (c)(6) of this section as follows:

(1) The outlet sampling site shall be the same as for the particulate matter measurement. The inlet site shall be selected according to Method 1, or as specified by the Administrator.

(2) Randomly select 9 sampling points within the cross-section at both the inlet and outlet sampling sites. Use the first set of three for the first run, the second set for the second run, and the third set for the third run.

(3) Simultaneously with each particulate matter run, extract and analyze for CO_2 an integrated gas sample according to Method 3, traversing the three sample points and sampling at each point for equal increments of time. Conduct the runs at both inlet and outlet sampling sites.

(4) Measure the volumetric flow rate at the inlet during each particulate matter run according to Method 2, using the full number of traverse points. For the inlet make two full velocity traverses approximately one hour apart during each run and average the results. The outlet volumetric flow rate may be determined from the particulate matter run (Method 5).

(5) Calculate the adjusted CO_2 percentage using the following equation:

$$(\%\ CO_2)_{adj} = (\%\ CO_2)_{di}\ (Q_{di}/Q_{do})$$

where:

$(\%\ CO_2)_{adj}$ is the adjusted CO_2 percentage which removes the effect of CO_2 absorption and dilution air,

$(\%\ CO_2)_{di}$ is the percentage of CO_2 measured before the scrubber, dry basis,

Q_{di} is the volumetric flow rate before the scrubber, average of two runs, dscf/min (using Method 2), and

Q_{do} is the volumetric flow rate after the scrubber, dscf/min (using Methods 2 and 5).

(6) Alternatively, the following procedures may be substituted for the procedures under paragraphs (c) (3), (4), and (5) of this section:

(i) Simultaneously with each particulate matter run, extract and analyze for CO_2, O_2, and N_2 an integrated gas sample according to Method 3, traversing the three sample points and sampling for equal increments of time at each point. Conduct the runs at both the inlet and outlet sampling sites.

(ii) After completing the analysis of the gas sample, calculate the percentage of excess air (% EA) for both the inlet and outlet sampling sites using equation 3–1 in Appendix A to this part.

(iii) Calculate the adjusted CO_2 percentage using the following equation:

$$(\%\ CO_2)_{adj} = (\%\ CO_2)_{di} \left[\frac{100 + (\%\ EA)_i}{100 + (\%\ EA)_o}\right]$$

where:

$(\%\ CO_2)_{adj}$ is the adjusted outlet CO_2 percentage,

$(\%\ CO_2)_{di}$ is the percentage of CO_2 measured before the scrubber, dry basis,

$(\%\ EA)_i$ is the percentage of excess air at the inlet, and

$(\%\ EA)_o$ is the percentage of excess air at the outlet.

(d) Particulate matter emissions, expressed in g/dscm, shall be corrected to 12 percent CO_2 by using the following formula:

$$c_{12} = \frac{12c}{\%\ CO_2}$$

where:

c_{12} is the concentration of particulate matter corrected to 12 percent CO_2,

c is the concentration of particulate matter as measured by Method 5, and

$\%\ CO_2$ is the percentage of CO_2 as measured by Method 3, or when applicable, the adjusted outlet CO_2 percentage as determined by paragraph (c) of this section.

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).).[68]

36 FR 24876, 12/23/71 (1)

as amended

39 FR 20790, 6/14/74 (8)
42 FR 37936, 7/25/77 (64)
42 FR 41424, 8/17/77 (68)

Subpart F—Standards of Performance for Portland Cement Plants

§ 60.60 Applicability and designation of affected facility.[64]

(a) The provisions of this subpart are applicable to the following affected facilities in portland cement plants: kiln, clinker cooler, raw mill system, finish mill system, raw mill dryer, raw material storage, clinker storage, finished product storage, conveyor transfer points, bagging and bulk loading and unloading systems.

(b) Any facility under paragraph (a) of this section that commences construction or modification after August 17, 1971, is subject to the requirements of this subpart.

§ 60.61 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in Subpart A of this part.

(a) "Portland cement plant" means any facility manufacturing portland cement by either the wet or dry process.[8]

§ 60.62 Standard for particulate matter.[8]

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any kiln any gases which:

(1) Contain particulate matter in excess of 0.15 kg per metric ton of feed (dry basis) to the kiln (0.30 lb per ton).

(2) Exhibit greater than 20 percent opacity.[10]

(b) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any clinker cooler any gases which:

(1) Contain particulate matter in excess of 0.050 kg per metric ton of feed (dry basis) to the kiln (0.10 lb per ton).

(2) Exhibit 10 percent opacity, or greater.

(c) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility other than the kiln and clinker cooler any gases which exhibit 10 percent opacity, or greater.[18]

§ 60.63 Monitoring of operations.[8]

(a) The owner or operator of any portland cement plant subject to the provisions of this part shall record the daily production rates and kiln feed rates.

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).).[68]

§ 60.64 Test methods and procedures.[8]

(a) The reference methods in Appendix A to this part, except as provided for in § 60.8(b), shall be used to determine compliance with the standards prescribed in § 60.62 as follows:

(1) Method 5 for the concentration of particulate matter and the associated moisture content;

(2) Method 1 for sample and velocity traverses;

(3) Method 2 for velocity and volumetric flow rate; and

(4) Method 3 for gas analysis.

(b) For Method 5, the minimum sampling time and minimum sample volume for each run, except when process variables or other factors justify otherwise to the satisfaction of the Administrator, shall be as follows:

(1) 60 minutes and 0.85 dscm (30.0 dscf) for the kiln.

(2) 60 minutes and 1.15 dscm (40.6 dscf) for the clinker cooler.

(c) Total kiln feed rate (except fuels), expressed in metric tons per hour on a dry basis, shall be determined during each testing period by suitable methods; and shall be confirmed by a material balance over the production system.

(d) For each run, particulate matter emissions, expressed in g/metric ton of kiln feed, shall be determined by dividing the emission rate in g/hr by the kiln feed rate. The emission rate shall be determined by the equation, $g/hr = Q_s \times c$, where Q_s = volumetric flow rate of the total effluent in dscm/hr as determined in accordance with paragraph (a)(3) of this section, and c = particulate concentration in g/dscm as determined in accordance with paragraph (a)(1) of this section.

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).).[68]

36 FR 24876, 12/23/71 (1)
as amended
39 FR 20790, 6/14/74 (8)
39 FR 39872, 11/12/74 (10)
40 FR 46250, 10/6/75 (18)
42 FR 37936, 7/25/77 (64)
42 FR 41424, 8/17/77 (68)

Subpart G—Standards of Performance for Nitric Acid Plants

§ 60.70 Applicability and designation of affected facility.[64]

(a) The provisions of this subpart are applicable to each nitric acid production unit, which is the affected facility.

(b) Any facility under paragraph (a) of this section that commences construction or modification after August 17, 1971, is subject to the requirements of this subpart.

§ 60.71 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in Subpart A of this part.

(a) "Nitric acid production unit" means any facility producing weak nitric acid by either the pressure or atmospheric pressure process.

(b) "Weak nitric acid" means acid which is 30 to 70 percent in strength.

§ 60.72 Standard for nitrogen oxides.[3,8]

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility any gases which:

(1) Contain nitrogen oxides, expressed as NO_2, in excess of 1.5 kg per metric ton of acid produced (3.0 lb per ton), the production being expressed as 100 percent nitric acid.

(2) Exhibit 10 percent opacity, or greater.[18]

§ 60.73 Emission monitoring.[18]

(a) A continuous monitoring system for the measurement of nitrogen oxides shall be installed, calibrated, maintained, and operated by the owner or operator. The pollutant gas used to prepare calibration gas mixtures under paragraph 2.1, Performance Specification 2 and for calibration checks under § 60.13(d) to this part, shall be nitrogen dioxide (NO_2). The span shall be set at 500 ppm of nitrogen dioxide. Reference Method 7 shall be used for conducting monitoring system performance evaluations under § 60.13(c).

(b) The owner or operator shall establish a conversion factor for the purpose of converting monitoring data into units of the applicable standard (kg/metric ton, lb/short ton). The conversion factor shall be established by measuring emissions with the continuous monitoring system concurrent with measuring emissions with the applicable reference method tests. Using only that portion of the continuous monitoring emission data that represents emission measurements concurrent with the reference method test periods, the conversion factor shall be determined by dividing the reference method test data averages by the monitoring data averages to obtain a ratio expressed in units of the applicable standard to units of the monitoring data, i.e., kg/metric ton per ppm (lb/short ton per ppm). The conversion factor shall be reestablished during any performance test under § 60.8 or any continuous monitoring system performance evaluation under § 60.13(c).

(c) The owner or operator shall record the daily production rate and hours of operation.

(d) [Reserved] [8]

(e) For the purpose of reports required under § 60.7(c), periods of excess emissions that shall be reported are defined as any three-hour period during which the average nitrogen oxides emissions (arithmetic average of three contiguous one-hour periods) as measured by a continuous monitoring system exceed the standard under § 60.72(a).[4,18]

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).).[68]

§ 60.74 Test methods and procedures.[8]

(a) The reference methods in Appendix A to this part, except as provided for in § 60.8(b), shall be used to determine compliance with the standard prescribed in § 60.72 as follows:

(1) Method 7 for the concentration of NO_x;

(2) Method 1 for sample and velocity traverses;

(3) Method 2 for velocity and volumetric flow rate; and

(4) Method 3 for gas analysis.

(b) For Method 7, the sample site shall be selected according to Method 1 and the sampling point shall be the centroid of the stack or duct or at a point no closer to the walls than 1 m (3.28 ft). Each run shall consist of at least four grab samples taken at approximately 15-minutes intervals. The arithmetic mean of the samples shall constitute the run value. A velocity traverse shall be performed once per run.

(c) Acid production rate, expressed in metric tons per hour of 100 percent nitric acid, shall be determined during each testing period by suitable methods and shall be confirmed by a material balance over the production system.

(d) For each run, nitrogen oxides, expressed in g/metric ton of 100 percent nitric acid, shall be determined by dividing the emission rate in g/hr by the acid production rate. The emission rate shall be determined by the equation.

$$g/hr = Q_s \times c$$

where Q_s = volumetric flow rate of the effluent in dscm/hr, as determined in accordance with paragraph (a)(3) of this section, and $c = NO_x$ concentration in g/dscm, as determined in accordance with paragraph (a)(1) of this section.

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).).[68]

36 FR 24876, 12/23/71 (1)
as amended
38 FR 13562, 5/23/73 (3)
38 FR 28564, 10/15/73 (4)
39 FR 20790, 6/14/74 (8)
40 FR 46250, 10/6/75 (18)
42 FR 37936, 7/25/77 (64)
42 FR 41424, 8/17/77 (68)

Subpart H—Standards of Performance for Sulfuric Acid Plants

§ 60.80 Applicability and designation of affected facility. 64

(a) The provisions of this subpart are applicable to each sulfuric acid production unit, which is the affected facility.

(b) Any facility under paragraph (a) of this section that commences construction or modification after August 17, 1971, is subject to the requirements of this subpart.

§ 60.81 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in Subpart A of this part.

(a) "Sulfuric acid production unit" means any facility producing sulfuric acid by the contact process by burning elemental sulfur, alkylation acid, hydrogen sulfide, organic sulfides and mercaptans, or acid sludge, but does not include facilities where conversion to sulfuric acid is utilized primarily as a means of preventing emissions to the atmosphere of sulfur dioxide or other sulfur compounds.

(b) "Acid mist" means sulfuric acid mist, as measured by Method 8 of Appendix A to this part or an equivalent or alternative method.[8]

§ 60.82 Standard for sulfur dioxide.[8]

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility any gases which contain sulfur dioxide in excess of 2 kg per metric ton of acid produced (4 lb per ton), the production being expressed as 100 percent H_2SO_4.

§ 60.83 Standard for acid mist.[3, 8]

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility any gases which:

(1) Contain acid mist, expressed as H_2SO_4, in excess of 0.075 kg per metric ton of acid produced (0.15 lb per ton), the production being expressed as 100 percent H_2SO_4.

(2) Exhibit 10 percent opacity, or greater. 18

§ 60.84 Emission monitoring.[18]

(a) A continuous monitoring system for the measurement of sulfur dioxide shall be installed, calibrated, maintained, and operated by the owner or operator. The pollutant gas used to prepare calibration gas mixtures under paragraph 2.1, Performance Specification 2 and for calibration checks under § 60.13(d) to this part, shall be sulfur dioxide (SO_2). Reference Method 8 shall be used for conducting monitoring system performance evaluations under § 60.13(c) except that only the sulfur dioxide portion of the Method 8 results shall be used. The span shall be set at 1000 ppm of sulfur dioxide.

(b) The owner or operator shall establish a conversion factor for the purpose of converting monitoring data into units of the applicable standard (kg/metric ton, lb/short ton). The conversion factor shall be determined, as a minimum, three times daily by measuring the concentration of sulfur dioxide entering the converter using suitable methods (e.g., the Reich test, National Air Pollution Control Administration Publication No. 999-AP-13 and calculating the appropriate conversion factor for each eight-hour period as follows:

$$CF = k\left[\frac{1.000-0.015r}{r-s}\right]$$

where:

CF = conversion factor (kg/metric ton per ppm, lb/short ton per ppm).

k = constant derived from material balance. For determining CF in metric units, k=0.0653. For determining CF in English units, k=0.1306.

r = percentage of sulfur dioxide by volume entering the gas converter. Appropriate corrections must be made for air injection plants subject to the Administrator's approval.

s = percentage of sulfur dioxide by volume in the emissions to the atmosphere determined by the continuous monitoring system required under paragraph (a) of this section.

(c) The owner or operator shall record all conversion factors and values under paragraph (b) of this section from which they were computed (i.e., CF, r, and s).

(d) [Reserved][8]

(e) For the purpose of reports under § 60.7(c), periods of excess emissions shall be all three-hour periods (or the arithmetic average of three consecutive one-hour periods) during which the integrated average sulfur dioxide emissions exceed the applicable standards under § 60.82.[4, 18]

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).). 68

§ 60.85 Test methods and procedures.[8]

(a) The reference methods in Appendix A to this part, except as provided for in § 60.8(b), shall be used to determine compliance with the standards prescribed in §§ 60.82 and 60.83 as follows:

(1) Method 8 for the concentrations of SO_2 and acid mist;

(2) Method 1 for sample and velocity traverses;

(3) Method 2 for velocity and volumetric flow rate; and

(4) Method 3 for gas analysis.

(b) The moisture content can be considered to be zero. For Method 8 the sampling time for each run shall be at least 60 minutes and the minimum sample volume shall be 1.15 dscm (40.6 dscf) except that smaller sampling times or sample volumes, when necessitated by process variables or other factors, may be approved by the Administrator.

(c) Acid production rate, expressed in metric tons per hour of 100 percent H_2SO_4, shall be determined during each testing period by suitable methods and shall be confirmed by a material balance over the production system.

(d) Acid mist and sulfur dioxide emissions, expressed in g/metric ton of 100 percent H_2SO_4, shall be determined by dividing the emission rate in g/hr by the acid production rate. The emission rate shall be determined by the equation, $g/hr = Q_s \times c$, where Q_s = volumetric flow rate of the effluent in dscm/hr as determined in accordance with paragraph (a)(3) of this section, and c = acid mist and SO_2 concentrations in g/dscm as determined in accordance with paragraph (a)(1) of this section.

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).). 68

36 FR 24876, 12/23/71 (1)

as amended

38 FR 13562, 5/23/73 (3)
38 FR 28564, 10/15/73 (4)
39 FR 20790, 6/14/74 (8)
40 FR 46250, 10/6/75 (18)
42 FR 37936, 7/25/77 (64)
42 FR 41424, 8/17/77 (68)

Subpart I—Standards of Performance for Asphalt Concrete Plants [5]

§ 60.90 Applicability and designation of affected facility. [64]

(a) The affected facility to which the provisions of this subpart apply is each asphalt concrete plant. For the purpose of this subpart, an asphalt concrete plant is comprised only of any combination of the following: dryers; systems for screening, handling, storing, and weighing hot aggregate; systems for loading, transferring, and storing mineral filler; systems for mixing asphalt concrete; and the loading, transfer, and storage systems associated with emission control systems.

(b) Any facility under paragraph (a) of this section that commences construction or modification after June 11, 1973, is subject to the requirements of this subpart.

§ 60.91 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in subpart A of this part.

(a) "Asphalt concrete plant" means any facility, as described in § 60.90, used to manufacture asphalt concrete by heating and drying aggregate and mixing with asphalt cements.

§ 60.92 Standard for particulate matter.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall discharge or cause the discharge into the atmosphere from any affected facility any gases which:

(1) Contain particulate matter in excess of 90 mg/dscm (0.04 gr/dscf).

(2) Exhibit 20 percent opacity, or greater. [18]

§ 60.93 Test methods and procedures.

(a) The reference methods appended to this part, except as provided for in § 60.8(b), shall be used to determine compliance with the standards prescribed in § 60.92 as follows:

(1) Method 5 for the concentration of particulate matter and the associated moisture content,

(2) Method 1 for sample and velocity traverses,

(3) Method 2 for velocity and volumetric flow rate, and

(4) Method 3 for gas analysis.

(b) For Method 5, the sampling time for each run shall be at least 60 minutes and the sampling rate shall be at least 0.9 dscm/hr (0.53 dscf/min) except that shorter sampling times, when necessitated by process variables or other factors, may be approved by the Administrator.

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).). [68]

36 FR 24876, 12/23/71 (1)
as amended
39 FR 9308, 3/8/74 (5)
40 FR 46250, 10/6/75 (18)
42 FR 37936, 7/25/77 (64)
42 FR 41424, 8/17/77 (68)

Subpart J—Standards of Performance for Petroleum Refineries[5]

§ 60.100 Applicability and designation of affected facility.[64]

(a) The provisions of this subpart are applicable to the following affected facilities in petroleum refineries: fluid catalytic cracking unit catalyst regenerators, fluid catalytic cracking unit incinerator-waste heat boilers, and fuel gas combustion devices.

(b) Any facility under paragraph (a) of this section that commences construction or modification after June 11, 1973, is subject to the requirements of this subpart.

§ 60.101 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in subpart A.

(a) "Petroleum refinery" means any facility engaged in producing gasoline, kerosene, distillate fuel oils, residual fuel oils, lubricants, or other products through distillation of petroleum or through redistillation, cracking or reforming of unfinished petroleum derivatives.

(b) "Petroleum" means the crude oil removed from the earth and the oils derived from tar sands, shale, and coal.

(c) "Process gas" means any gas generated by a petroleum refinery process unit, except fuel gas and process upset gas as defined in this section.

(d) "Fuel gas" means any gas which is generated by a petroleum refinery process unit and which is combusted, including any gaseous mixture of natural gas and fuel gas which is combusted.

(e) "Process upset gas" means any gas generated by a petroleum refinery process unit as a result of start-up, shut-down, upset or malfunction.

(f) "Refinery process unit" means any segment of the petroleum refinery in which a specific processing operation is conducted.

(g) "Fuel gas combustion device" means any equipment, such as process heaters, boilers and flares used to combust fuel gas, but does not include fluid coking unit and fluid catalytic cracking unit incinerator-waste heat boilers or facilities in which gases are combusted to produce sulfur or sulfuric acid.

(h) "Coke burn-off" means the coke removed from the surface of the fluid catalytic cracking unit catalyst by combustion in the catalyst regenerator. The rate of coke burn-off is calculated by the formula specified in § 60.106.

§ 60.102 Standard for particulate matter.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall discharge or cause the discharge into the atmosphere from any fluid catalytic cracking unit catalyst regenerator or from any fluid catalytic cracking unit incinerator-waste heat boiler:

(1) Particulate matter in excess of 1.0 kg/1000 kg (1.0 lb/1000 lb) of coke burn-off in the catalyst regenerator.

(2) Gases exhibiting greater than 30 percent opacity, except for one six-minute average opacity reading in any one hour period.[18,61,66]

(b) In those instances in which auxiliary liquid or solid fossil fuels are burned in the fluid catalytic cracking unit incinerator-waste heat boiler, particular matter in excess of that permitted by paragraph (a)(1) of this section may be emitted to the atmosphere, except that the incremental rate of particulate emissions shall not exceed 0.18 g/million cal (0.10 lb/million Btu) of heat input attributable to such liquid or solid fuel.

§ 60.103 Standard for carbon monoxide.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall discharge or cause the discharge into the atmosphere from the fluid catalytic cracking unit catalyst regenerator any gases which contain carbon monoxide in excess of 0.050 percent by volume.

§ 60.104 Standard for sulfur dioxide.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall burn in any fuel gas combustion device any fuel gas which contains H_2S in excess of 230 mg/dscm (0.10 gr/dscf), except as provided in paragraph (b) of this section. The combustion of process upset gas in a flare, or the combustion in a flare of process gas or fuel gas which is released to the flare as a result of relief valve leakage, is exempt from this paragraph.

(b) The owner or operator may elect to treat the gases resulting from the combustion of fuel gas in a manner which limits the release of SO_2 to the atmosphere if it is shown to the satisfaction of the Administrator that this prevents SO_2 emissions as effectively as compliance with the requirements of paragraph (a) of this section.

§ 60.105 Emission monitoring.[18]

(a) Continuous monitoring systems shall be installed, calibrated, maintained, and operated by the owner or operator as follows:

(1) A continuous monitoring system for the measurement of the opacity of emissions discharged into the atmosphere from the fluid catalytic cracking unit catalyst regenerator. The continuous monitoring system shall be spanned at 60, 70, or 80 percent opacity.

(2) [Reserved]

(3) A continuous monitoring system for the measurement of sulfur dioxide in the gases discharged into the atmosphere from the combustion of fuel gases (except where a continuous monitoring system for the measurement of hydrogen sulfide is installed under paragraph (a)(4) of this section). The pollutant gas used to prepare calibration gas mixtures under paragraph 2.1, Performance Specification 2 and for calibration checks under § 60.13(d) to this part, shall be sulfur dioxide (SO_2). The span shall be set at 100 ppm. For conducting monitoring system performance evaluations under § 60.13(c), Reference Method 6 shall be used.

(4) [Reserved]

(b) [Reserved]

(c) The average coke burn-off rate (thousands of kilogram/hr) and hours of operation for any fluid catalytic cracking unit catalyst regenerator subject to § 60.102 or 60.103 shall be recorded daily.

(d) For any fluid catalytic cracking unit catalyst regenerator which is subject to § 60.102 and which utilizes an incinerator-waste heat boiler to combust the exhaust gases from the catalyst regenerator, the owner or operator shall record daily the rate of combustion of liquid or solid fossil fuels (liters/hr or kilograms/hr) and the hours of operation during which liquid or solid fossil fuels are combusted in the incinerator-waste heat boiler.

(e) For the purpose of reports under § 60.7(c), periods of excess emissions that shall be reported are defined as follows:

(1) Opacity.

All one- hour periods which contain two or more six-minute periods during which the average opacity as measured by the continuous monitoring system exceeds 30 percent.[61,66]

(2) [Reserved]

(3) [Reserved]

(4) Any six-hour period during which the average emissions (arithmetic average of six contiguous one-hour periods) of sulfur dioxide as measured by a continuous monitoring system exceed the standard under § 60.104.

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).).[68]

§ 60.106 Test methods and procedures.

(a) For the purpose of determining compliance with § 60.102(a)(1), the following reference methods and calculation procedures shall be used:

(1) For gases released to the atmosphere from the fluid catalytic cracking unit catalyst regenerator:

(i) Method 5 for the concentration of particulate matter and moisture content,

(ii) Method 1 for sample and velocity traverses, and

(iii) Method 2 for velocity and volumetric flow rate.

(2) For Method 5, the sampling time for each run shall be at least 60 minutes and the sampling rate shall be at least 0.015 dscm/min (0.53 dscf/min), except that shorter sampling times may be ap-

proved by the Administrator when process variables or other factors preclude sampling for at least 60 minutes.

(3) For exhaust gases from the fluid catalytic cracking unit catalyst regenerator prior to the emission control system: the integrated sample techniques of Method 3 and Method 4 for gas analysis and moisture content, respectively; Method 1 for velocity traverses; and Method 2 for velocity and volumetric flow rate.

(4) Coke burn-off rate shall be determined by the following formula:

$$R_c=0.2982\,Q_{RE}\,(\%CO_2+\%CO)+2.088\,Q_{RA}-0.0994\,Q_{RE}\left(\frac{\%CO}{2}+\%CO_2+\%O_2\right)\ \text{(Metric Units)}$$

or

$$R_c=0.0186\,Q_{RE}\,(\%CO_2+\%CO)+0.1303\,Q_{RA}-0.0062\,Q_{RE}\left(\frac{\%CO}{2}+\%CO_2+\%O_2\right)\ \text{(English Units)}$$

where:

R_c=coke burn-off rate, kg/hr (English units: lb/hr).
0.2982=metric units material balance factor divided by 100, kg-min/hr-m^3.
0.0186=English units material balance factor divided by 100, lb-min/hr-ft^3.
Q_{RE}=fluid catalytic cracking unit catalyst regenerator exhaust gas flow rate before entering the emission control system, as determined by method 2, dscm/min (English units: dscf/min).
$\%CO_2$=percent carbon dioxide by volume, dry basis, as determined by Method 3.
$\%CO$=percent carbon monoxide by volume, dry basis, as determined by Method 3.
$\%O_2$=percent oxygen by volume, dry basis, as determined by Method 3.
2.088=metric units material balance factor divided by 100, kg-min/hr-m^3.
0.1303=English units material balance factor divided by 100, lb-min/hr-ft^3.
Q_{RA}=air rate to fluid catalytic cracking unit catalyst regenerator, as determined from fluid catalytic cracking unit control room instrumentation, dscm/min (English units: dscf/min).
0.0994=metric units material balance factor divided by 100, kg-min/hr-m^3.
0.0062=English units material balance factor divided by 100, lb-min/hr-ft^3.

(5) Particulate emissions shall be determined by the following equation:

$$R_E=(60\times10^{-6})Q_{RV}C_s\ \text{(Metric Units)}$$

or

$$R_E=(8.57\times10^{-3})Q_{RV}C_s\ \text{(English Units)}$$

where:

R_E=particulate emission rate, kg/hr (English units: lb/hr).
60×10^{-6}=metric units conversion factor, min-kg/hr-mg.
8.57×10^{-3}=English units conversion factor, min-lb/hr-gr.
Q_{RV}=volumetric flow rate of gases discharged into the atmosphere from the fluid catalytic cracking unit catalyst regenerator following the emission control system, as determined by Method 2, dscm/min (English units: dscf/min).
C_s=particulate emission concentration discharged into the atmosphere, as determined by Method 5, mg/dscm (English units: gr/dscf).

(6) For each run, emissions expressed in kg/1000 kg (English units: lb/1000 lb) of coke burn-off in the catalyst regenerator shall be determined by the following equation:

$$R_s=1000\frac{R_E}{R_c}\ \text{(Metric or English Units)}$$

where:

R_s=particulate emission rate, kg/1000 kg (English units: lb/1000 lb) of coke burn-off in the fluid catalytic cracking unit catalyst regenerator.
1000=conversion factor, kg to 1000 kg (English units: lb to 1000 lb).
R_E=particulate emission rate, kg/hr (English units: lb/hr).
R_c=coke burn-off rate, kg/hr (English units: lb/hr).

(7) In those instances in which auxiliary liquid or solid fossil fuels are burned in an incinerator-waste heat boiler, the rate of particulate matter emissions permitted under § 60.102(b) must be determined. Auxiliary fuel heat input, expressed in millions of cal/hr (English units: Millions of Btu/hr) shall be calculated for each run by fuel flow rate measurement and analysis of the liquid or solid auxiliary fossil fuels. For each run, the rate of particulate emissions permitted under § 60.102(b) shall be calculated from the following equation:

$$R_s=1.0+\frac{0.18\,H}{R_c}\ \text{(Metric Units)}$$

or

$$R_s=1.0+\frac{0.10\,H}{R_c}\ \text{(English Units)}$$

where:

R_s=allowable particulate emission rate, kg/1000 kg (English units: lb/1000 lb) of coke burn-off in the fluid catalytic cracking unit catalyst regenerator.
1.0=emission standard, 1.0 kg/1000 kg (English units: 1.0 lb/1000 lb) of coke burn-off in the fluid catalytic cracking unit catalyst regenerator.
0.18=metric units maximum allowable incremental rate of particulate emissions, g/million cal.
0.10=English units maximum allowable incremental rate of particulate emissions, lb/million Btu.
H=heat input from solid or liquid fossil fuel, million cal/hr (English units: million Btu/hr).
R_c=coke burn-off rate, kg/hr (English units: lb/hr).

(b) For the purpose of determining compliance with § 60.103, the integrated sample technique of Method 10 shall be used. The sample shall be extracted at a rate proportional to the gas velocity at a sampling point near the centroid of the duct. The sampling time shall not be less than 60 minutes.

(c) For the purpose of determining compliance with § 60.104(a), Method 11 shall be used. When refinery fuel gas lines are operating at pressures substantially above atmospheric, the gases sampled must be introduced into the sampling train at approximately atmospheric pressure. This may be accomplished with a flow control valve. If the line pressure is high enough to operate the sampling train without a vacuum pump, the pump may be eliminated from the sampling train. The sample shall be drawn from a point near the centroid of the fuel gas line. The minimum sampling time shall be 10 minutes and the minimum sampling volume 0.01 dscm (0.35 dscf) for each sample. The arithmetic average of two samples shall constitute one run. Samples shall be taken at approximately 1-hour intervals. For most fuel gases, sample times exceeding 20 minutes may result in depletion of the collecting solution, although fuel gases containing low concentrations of hydrogen sulfide may necessitate sampling for longer periods of time.

(d) Method 6 shall be used for determining concentration of SO_2 in determining compliance with § 60.104(b), except that H_2S concentration of the fuel gas may be determined instead. Method 1 shall be used for velocity traverses and Method 2 for determining velocity and volumetric flow rate. The sampling site for determining SO_2 concentration by Method 6 shall be the same as for determining volumetric flow rate by Method 2. The sampling point in the duct for determining SO_2 concentration by Method 6 shall be at the centroid of the cross section if the cross sectional area is less than 5 m^2 (54 ft^2) or at a point no closer to the walls than 1 m (39 inches) if the cross sectional area is 5 m^2 or more and the centroid is more than one meter from the wall. The sample shall be extracted at a rate proportional to the gas velocity at the sampling point. The minimum sampling time shall be 10 minutes and the minimum sampling volume 0.01 dscm (0.35 dscf) for each sample. The arithmetic average of two samples shall constitute one run. Samples shall be taken at approximately 1-hour intervals.

(e) An owner or operator of an affected facility may request the Administrator to determine opacity of emissions from the affected facility during any performance test covered under § 60.8. In such event the provisions of §§ 60.11 (e) (2), (e) (3), and (e) (4) shall apply.[61]

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).).[68]

36 FR 24876, 12/23/71 (1)
as amended
39 FR 9308, 3/8/74 (5)
40 FR 46250, 10/6/75 (18)
42 FR 32426, 6/24/77 (61)
42 FR 37936, 7/25/77 (64)
42 FR 39389, 8/4/77 (66)
42 FR 41424, 8/17/77 (68)

Subpart K—Standards of Performance for Storage Vessels for Petroleum Liquids[5]

§ 60.110 Applicability and designation of affected facility.[64]

(a) Except as provided in § 60.110(b), the affected facility to which this subpart applies is each storage vessel for petroleum liquids which has a storage capacity greater than 151,412 liters (40,000 gallons).

(b) This subpart does not apply to storage vessels for petroleum or condensate stored, processed, and/or treated at a drilling and production facility prior to custody transfer.[8]

(c) Subject to the requirements of this subpart is any facility under paragraph (a) of this section which:

(1) Has a capacity greater than 151,412 liters (40,000 gallons), but not exceeding 245,000 liters (65,000 gallons, and commences construction or modification after March 8, 1974.

(2) Has a capacity greater than 245,000 liter (65,000 gallons), and commences construction or modification after June 11, 1973.

§ 60.111 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in Subpart A of this part.

(a) "Storage vessel" means any tank, reservoir, or container used for the storage of petroleum liquids, but does not include:

(1) Pressure vessels which are designed to operate in excess of 15 pounds per square inch gauge without emissions to the atmosphere except under emergency conditions,

(2) Subsurface caverns or porous rock reservoirs, or

(3) Underground tanks if the total volume of petroleum liquids added to and taken from a tank annually does not exceed twice the volume of the tank.

(b) "Petroleum liquids" means petroleum, condensate, and any finished or intermediate products manufactured in a petroleum refinery but does not mean Number 2 through Number 6 fuel oils as specified in A.S.T.M. D396-69, gas turbine fuel oils Numbers 2-GT through 4-GT as specified in A.S.T.M. D2880-71, or diesel fuel oils Numbers 2-D and 4-D as specified in A.S.T.M. D975-68.[8]

(c) "Petroleum refinery" means any facility engaged in producing gasoline, kerosene, distillate fuel oils, residual fuel oils, lubricants, or other products through distillation of petroleum or through redistillation, cracking, or reforming of unfinished petroleum derivatives.

(d) "Petroleum" means the crude oil removed from the earth and the oils derived from tar sands, shale, and coal.[8]

(e) "Hydrocarbon" means any organic compound consisting predominantly of carbon and hydrogen.[6]

(f) "Condensate" means hydrocarbon liquid separated from natural gas which condenses due to changes in the temperature and/or pressure and remains liquid at standard conditions.

(g) "Custody transfer" means the transfer of produced petroleum and/or condensate, after processing and/or treating in the producing operations, from storage tanks or automatic transfer facilities to pipelines or any other forms of transportation.[8]

(h) "Drilling and production facility" means all drilling and servicing equipment, wells, flow lines, separators, equipment, gathering lines, and auxiliary nontransportation-related equipment used in the production of petroleum but does not include natural gasoline plants.[8]

(i) "True vapor pressure" means the equilibrium partial pressure exerted by a petroleum liquid as determined in accordance with methods described in American Petroleum Institute Bulletin 2517, Evaporation Loss from Floating Roof Tanks, 1962.

(j) "Floating roof" means a storage vessel cover consisting of a double deck, pontoon single deck, internal floating cover or covered floating roof, which rests upon and is supported by the petroleum liquid being contained, and is equipped with a closure seal or seals to close the space between the roof edge and tank wall.

(k) "Vapor recovery system" means a vapor gathering system capable of collecting all hydrocarbon vapors and gases discharged from the storage vessel and a vapor disposal system capable of processing such hydrocarbon vapors and gases so as to prevent their emission to the atmosphere.

(l) "Reid vapor pressure" is the absolute vapor pressure of volatile crude oil and volatile non-viscous petroleum liquids, except liquified petroleum gases, as determined by ASTM-D-323-58 (reapproved 1968).

§ 60.112 Standard for hydrocarbons.

(a) The owner or operator of any storage vessel to which this subpart applies shall store petroleum liquids as follows:

(1) If the true vapor pressure of the petroleum liquid, as stored, is equal to or greater than 78 mm Hg (1.5 psia) but not greater than 570 mm Hg (11.1 psia), the storage vessel shall be equipped with a floating roof, a vapor recovery system, or their equivalents.

(2) If the true vapor pressure of the petroleum liquid as stored is greater than 570 mm Hg (11.1 psia), the storage vessel shall be equipped with a vapor recovery system or its equivalent.

§ 60.113 Monitoring of operations.

(a) The owner or operator of any storage vessel to which this subpart applies shall for each such storage vessel maintain a file of each type of petroleum liquid stored, of the typical Reid vapor pressure of each type of petroleum liquid stored, and of the dates of storage. Dates on which the storage vessel is empty shall be shown.

(b) The owner or operator of any storage vessel to which this subpart applies shall for each such storage vessel determine and record the average monthly storage temperature and true vapor pressure of the petroleum liquid stored at such temperature if:

(1) The petroleum liquid has a true vapor pressure, as stored, greater than 26 mm Hg (0.5 psia) but less than 78 mm Hg (1.5 psia) and is stored in a storage vessel other than one equipped with a floating roof, a vapor recovery system or their equivalents; or

(2) The petroleum liquid has a true vapor pressure, as stored, greater than 470 mm Hg (9.1 psia) and is stored in a storage vessel other than one equipped with a vapor recovery system or its equivalent.

(c) The average monthly storage temperature is an arithmetic average calculated for each calendar month, or portion thereof if storage is for less than a month, from bulk liquid storage temperatures determined at least once every 7 days.

(d) The true vapor pressure shall be determined by the procedures in API Bulletin 2517. This procedure is dependent upon determination of the storage temperature and the Reid vapor pressure, which requires sampling of the petroleum liquids in the storage vessels. Unless the Administrator requires in specific cases that the stored petroleum liquid be sampled, the true vapor pressure may be determined by using the average monthly storage temperature and the typical Reid vapor pressure. For those liquids for which certified specifications limiting the Reid vapor pressure exist, that Reid vapor pressure may be used. For other liquids, supporting analytical data must be made available on request to the Administrator when typical Reid vapor pressure is used.

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).).[68]

36 FR 24876, 12/23/71 (1)

as amended

39 FR 9308, 3/8/74 (5)
39 FR 20790, 6/14/74 (8)
42 FR 37936, 7/25/77 (64)
42 FR 41424, 8/17/77 (68)

Subpart L—Standards of Performance for Secondary Lead Smelters [5]

§ 60.120 Applicability and designation of affected facility.[64]

(a) The provisions of this subpart are applicable to the following affected facilities in secondary lead smelters: pot furnaces of more than 250 kg (550 lb) charging capacity, blast (cupola) furnaces, and reverberatory furnaces.

(b) Any facility under paragraph (a) of this section that commences construction or modification after June 11, 1973, is subject to the requirements of this subpart.

§ 60.121 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in subpart A of this part.

(a) "Reverberatory furnace" includes the following types of reverberatory furnaces: stationary, rotating, rocking, and tilting.

(b) "Secondary lead smelter" means any facility producing lead from a lead-bearing scrap material by smelting to the metallic form.

(c) "Lead" means elemental lead or alloys in which the predominant component is lead. [6]

§ 60.122 Standard for particulate matter.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall discharge or cause the discharge into the atmosphere from a blast (cupola) or reverberatory furnace any gases which:

(1) Contain particulate matter in excess of 50 mg/dscm (0.022 gr/dscf).

(2) Exhibit 20 percent opacity or greater.

(b) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall discharge or cause the discharge into the atmosphere from any pot furnace any gases which exhibit 10 percent opacity or greater. [18]

§ 60.123 Test methods and procedures.

(a) The reference methods appended to this part, except as provided for in § 60.8 (b), shall be used to determine compliance with the standards prescribed in § 60.122 as follows:

(1) Method 5 for the concentration of particulate matter and the associated moisture content,

(2) Method 1 for sample and velocity traverses,

(3) Method 2 for velocity and volumetric flow rate, and

(4) Method 3 for gas analysis.

(b) For method 5, the sampling time for each run shall be at least 60 minutes and the sampling rate shall be at least 0.9 dscm/hr (0.53 dscf/min) except that shorter sampling times, when necessitated by process variables or other factors, may be approved by the Administrator. Particulate sampling shall be conducted during representative periods of furnace operation, including charging and tapping.

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-6).). [68]

36 FR 24876, 12/23/71 (1)

as amended

39 FR 9308, 3/8/74 (5)
39 FR 13776, 4/17/74 (6)
40 FR 46250, 10/6/75 (18)
42 FR 37936, 7/25/77 (64)
42 FR 41424, 8/17/77 (68)

Subpart M—Standards of Performance for Secondary Brass and Bronze Ingot Production Plants [5]

§ 60.130 Applicability and designation of affected facility.[64]

(a) The provisions of this subpart are applicable to the following affected facilities in secondary brass or bronze ingot production plants: reverberatory and electric furnaces of 1,000 kg (2,205 lb) or greater production capacity and blast (cupola) furnaces of 250 kg/hr (550 lb/hr) or greater production capacity.

(b) Any facility under paragraph (a) of this section that commences construction or modification after June 11, 1973, is subject to the requirements of this subpart.

§ 60.131 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in subpart A of this part.

(a) "Brass or bronze" means any metal alloy containing copper as its predominant constituent, and lesser amounts of zinc, tin, lead, or other metals.

(b) "Reverberatory furnace" includes the following types of reverberatory furnaces: Stationary, rotating, rocking, and tilting.

(c) "Electric furnace" means any furnace which uses electricity to produce over 50 percent of the heat required in the production of refined brass or bronze.

(d) "Blast furnace" means any furnace used to recover metal from slag.

§ 60.132 Standard for particulate matter.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall discharge or cause the discharge into the atmosphere from a reverberatory furnace any gases which:

(1) Contain particulate matter in excess of 50 mg/dscm (0.022 gr/dscf).

(2) Exhibit 20 percent opacity or greater.

(b) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall discharge or cause the discharge into the atmosphere from any blast (cupola) or electric furnace any gases which exhibit 10 percent opacity or greater.[18]

§ 60.133 Test methods and procedures.

(a) The reference methods appended to this part, except as provided for in § 60.8(b), shall be used to determine compliance with the standards prescribed in § 60.132 as follows:

(1) Method 5 for the concentration of particulate matter and the associated moisture content.

(2) Method 1 for sample and velocity traverses.

(3) Method 2 for velocity and volumetric flow rate, and

(4) Method 3 for gas analysis.

(b) For Method 5, the sampling time for each run shall be at least 120 minutes and the sampling rate shall be at least 0.9 dscm/hr (0.53 dscf/min) except that shorter sampling times, when necessitated by process variables or other factors, may be approved by the Administrator. Particulate matter sampling shall be conducted during representative periods of charging and refining, but not during pouring of the heat.

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).).[68]

36 FR 24876, 12/23/71 (1)
as amended
39 FR 9308, 3/8/74 (5)
40 FR 46250, 10/6/75 (18)
42 FR 37936, 7/25/77 (64)
42 FR 41424, 8/17/77 (68)

Subpart N—Standards of Performance for Iron and Steel Plants [5]

§ 60.140 Applicability and designation of affected facility. [64]

(a) The affected facility to which the provisions of this subpart apply is each basic oxygen process furnace.

(b) Any facility under paragraph (a) of this section that commences construction or modification after June 11, 1973, is subject to the requirements of this subpart.

§ 60.141 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in subpart A of this part.

(a) "Basic oxygen process furnace" (BOPF) means any furnace producing steel by charging scrap steel, hot metal, and flux materials into a vessel and introducing a high volume of an oxygen-rich gas.

(b) "Steel production cycle" means the operations required to produce each batch of steel and includes the following major functions: Scrap charging, preheating (when used), hot metal charging, primary oxygen blowing, additional oxygen blowing (when used), and tapping.

§ 60.142 Standard for particulate matter.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall discharge or cause the discharge into the atmosphere from any affected facility any gases which:

(1) Contain particulate matter in excess of 50 mg/dscm (0.022 gr/dscf).

(2) [Reserved.]

§ 60.143 [Reserved]

§ 60.144 Test methods and procedures.

(a) The reference methods appended to this part, except as provided for in § 60.8(b), shall be used to determine compliance with the standards prescribed in § 60.142 as follows:

(1) Method 5 for concentration of particulate matter and associated moisture content,

(2) Method 1 for sample and velocity traverses,

(3) Method 2 for volumetric flow rate, and

(4) Method 3 for gas analysis.

(b) For Method 5, the sampling for each run shall continue for an integral number of cycles with total duration of at least 60 minutes. The sampling rate shall be at least 0.9 dscm/hr (0.53 dscf/min) except that shorter sampling times, when necessitated by process variables or other factors, may be approved by the Administrator. A cycle shall start at the beginning of either the scrap preheat or the oxygen blow and shall terminate immediately prior to tapping.

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).). [68]

36 FR 24876, 12/23/71 (1)

as amended

39 FR 9308, 3/8/74 (5)
42 FR 37936, 7/25/77 (64)
42 FR 41424, 8/17/77 (68)

Subpart O—Standards of Performance for Sewage Treatment Plants [5]

§ 60.150 Applicability and designation of affected facility.[64]

(a) The affected facility to which the provisions of this subpart apply is each incinerator which burns the sludge produced by municipal sewage treatment facilities.

(b) Any facility under paragraph (a) of this section that commences construction or modification after June 11, 1973, is subject to the requirements of this subpart.

§ 60.151 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in subpart A of this part.

§ 60.152 Standard for particulate matter.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator of any sewage sludge incinerator subject to the provisions of this subpart shall discharge or cause the discharge into the atmosphere of:

(1) Particulate matter at a rate in excess of 0.65 g/kg dry sludge input (1.30 lb/ton dry sludge input).

(2) Any gases which exhibit 20 percent opacity or greater. [16]

§ 60.153 Monitoring of operations.

(a) The owner or operator of any sludge incinerator subject to the provisions of this subpart shall:

(1) Install, calibrate, maintain, and operate a flow measuring device which can be used to determine either the mass or volume of sludge charged to the incinerator. The flow measuring device shall have an accuracy of ±5 percent over its operating range.

(2) Provide access to the sludge charged so that a well-mixed representative grab sample of the sludge can be obtained.

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).). [68]

§ 60.154 Test Methods and Procedures.

(a) The reference methods appended to this part, except as provided for in § 60.8(b), shall be used to determine compliance with the standards prescribed in § 60.152 as follows:

(1) Method 5 for concentration of particulate matter and associated moisture content,

(2) Method 1 for sample and velocity traverses,

(3) Method 2 for volumetric flow rate, and

(4) Method 3 for gas analysis.

(b) For Method 5, the sampling time for each run shall be at least 60 minutes and the sampling rate shall be at least 0.015 dscm/min (0.53 dscf/min), except that shorter sampling times, when necessitated by process variables or other factors, may be approved by the Administrator.

(c) Dry sludge charging rate shall be determined as follows:

(1) Determine the mass (S_M) or volume (S_V) of sludge charged to the incinerator during each run using a flow measuring device meeting the requirements of § 60.153(a)(1). If total input during a run is measured by a flow measuring device, such readings shall be used. Otherwise, record the flow measuring device readings at 5-minute intervals during a run. Determine the quantity charged during each interval by averaging the flow rates at the beginning and end of the interval and then multiplying the average for each interval by the time for each interval. Then add the quantity for each interval to determine the total quantity charged during the entire run, (S_M) or (S_V).

(2) Collect samples of the sludge charged to the incinerator in non-porous collecting jars at the beginning of each run and at approximately 1-hour intervals thereafter until the test ends, and determine for each sample the dry sludge content (total solids residue) in accordance with "224 G. Method for Solid and Semisolid Samples," *Standard Methods for the Examination of Water and Wastewater*, Thirteenth Edition, American Public Health Association, Inc., New York, N.Y., 1971, pp. 539–41, except that:

(i) Evaporating dishes shall be ignited to at least 103°C rather than the 550°C specified in step 3(a)(1).

(ii) Determination of volatile residue, step 3(b) may be deleted.

(iii) The quantity of dry sludge per unit sludge charged shall be determined in terms of either R_{DV} (metric units: mg dry sludge/liter sludge charged or English units: lb/ft³) or R_{DM} (metric units: mg dry sludge/mg sludge charged or English units: lb/lb).

(3) Determine the quantity of dry sludge per unit sludge charged in terms of either R_{DV} or R_{DM}.

(i) If the volume of sludge charged is used:

$$S_D=(60\times10^{-3})\frac{R_{DV}S_V}{T}\ \text{(Metric Units)}$$

or

$$S_D=(8.021)\frac{R_{DV}S_V}{T}\ \text{(English Units)}$$

where:

S_D=average dry sludge charging rate during the run, kg/hr (English units: lb/hr).
R_{DV}=average quantity of dry sludge per unit volume of sludge charged to the incinerator, mg/l (English units: lb/ft³).
S_V=sludge charged to the incinerator during the run, m³ (English units: gal).
T=duration of run, min (English units: min).
60×10^{-3}=metric units conversion factor, l-kg-min/m³-mg-hr.
8.021=English units conversion factor, ft³min/gal-hr. 6

(ii) If the mass of sludge charged is used: 6

$$S_D=(60)\frac{R_{DM}S_M}{T}\ \text{(Metric or English Units)}$$

where.

S_D=average dry sludge charging rate during the run, kg/hr (English units: lb/hr).
R_{DM}=average ratio of quantity of dry sludge to quantity of sludge charged to the incinerator, mg/mg (English units: lb/lb).
S_M=sludge charged during the run, kg (English units: lb).
T=duration of run, min (Metric or English units).
60=conversion factor, min/hr (Metric or English units).

(d) Particulate emission rate shall be determined by:

$$c_{aw}=c_s Q_s\ \text{(Metric or English Units)}\qquad 7$$

where:

c_{aw}=Particulate matter mass emissions, mg/hr (English units: lb/hr).
c_s=Particulate matter concentration, mg/m³ (English units: lb/dscf).
Q_s=Volumetric stack gas flow rate, dscm/hr (English units: dscf/hr).
Q_s and c_s shall be determined using Methods 2 and 5, respectively.

(e) Compliance with § 60.152(a) shall be determined as follows:

$$C_{ds}=(10^{-3})\frac{c_{aw}}{S_D}\ \text{(Metric Units)}$$

or

$$C_{ds}=(2000)\frac{c_{aw}}{S_D}\ \text{(English Units)}$$

where:

C_{ds}=particulate emission discharge, g/kg dry sludge (English units: lb/ton dry sludge).
10^{-3}=Metric conversion factor, g/mg.
2000=English conversion factor, lb/ton.

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).). [68]

36 FR 24876, 12/23/71 (1)

as amended

39 FR 9308, 3/8/74 (5)
39 FR 13776, 4/17/74 (6)
39 FR 15396, 5/3/74 (7)
40 FR 46250, 10/6/75 (18)
42 FR 37936, 7/25/77 (64)
42 FR 41424, 8/17/77 (68)

Subpart P—Standards of Performance for Primary Copper Smelters[26]

§ 60.160 Applicability and designation of affected facility.[64]

(a) The provisions of this subpart are aplicable to the following affected facilities in primary copper smelters: dryer, roaster, smelting furnace, and copper converter.

(b) Any facility under paragraph (a) of this section that commences construction or modification after October 16, 1974, is subject to the requirements of this subpart.

§ 60.161 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in subpart A of this part.

(a) "Primary copper smelter" means any installation or any intermediate process engaged in the production of copper from copper sulfide ore concentrates through the use of pyrometallurgical techniques.

(b) "Dryer" means any facility in which a copper sulfide ore concentrate charge is heated in the presence of air to eliminate a portion of the moisture from the charge, provided less than 5 percent of the sulfur contained in the charge is eliminated in the facility.

(c) "Roaster" means any facility in which a copper sulfide ore concentrate charge is heated in the presence of air to eliminate a significant portion (5 percent or more) of the sulfur contained in the charge.

(d) "Calcine" means the solid materials produced by a roaster.

(e) "Smelting" means processing techniques for the melting of a copper sulfide ore concentrate or calcine charge leading to the formation of separate layers of molten slag, molten copper, and/or copper matte.

(f) "Smelting furnace" means any vessel in which the smelting of copper sulfide ore concentrates or calcines is performed and in which the heat necessary for smelting is provided by an electric current, rapid oxidation of a portion of the sulfur contained in the concentrate as it passes through an oxidizing atmosphere, or the combustion of a fossil fuel.

(g) "Copper converter" means any vessel to which copper matte is charged and oxidized to copper.

(h) "Sulfuric acid plant" means any facility producing sulfuric acid by the contact process.

(i) "Fossil fuel" means natural gas, petroleum, coal, and any form of solid, liquid, or gaseous fuel derived from such materials for the purpose of creating useful heat.

(j) "Reverberatory smelting furnace" means any vessel in which the smelting of copper sulfide ore concentrates or calcines is performed and in which the heat necessary for smelting is provided primarily by combustion of a fossil fuel.

(k) "Total smelter charge" means the weight (dry basis) of all copper sulfides ore concentrates processed at a primary copper smelter, plus the weight of all other solid materials introduced into the roasters and smelting furnaces at a primary copper smelter, except calcine, over a one-month period.

(l) "High level of volatile impurities" means a total smelter charge containing more than 0.2 weight percent arsenic, 0.1 weight percent antimony, 4.5 weight percent lead or 5.5 weight percent zinc, on a dry basis.

§ 60.162 Standard for particulate matter.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any dryer any gases which contain particulate matter in excess of 50 mg/dscm (0.022 gr/dscf).

§ 60.163 Standard for sulfur dioxide.

(b) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any roaster, smelting furnace, or copper converter any gases which contain sulfur dioxide in excess of 0.065 percent by volume, except as provided in paragraphs (b) and (c) of this section.

(b) Reverberatory smelting furnaces shall be exempted from paragraph (a) of this section during periods when the total smelter charge at the primary copper smelter contains a high level of volatile impurities.

(c) A change in the fuel combusted in a reverberatory furnace shall not be considered a modification under this part.

§ 60.164 Standard for visible emissions.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any dryer any visible emissions which exhibit greater than 20 percent opacity.

(b) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility that uses a sulfuric acid to comply with the standard set forth in § 60.163, any visible emissions which exhibit greater than 20 percent opacity.

§ 60.165 Monitoring of operations.

(a) The owner or operator of any primary copper smelter subject to § 60.163 (b) shall keep a monthly record of the total smelter charge and the weight percent (dry basis) of arsenic, antimony, lead and zinc contained in this charge. The analytical methods and procedures employed to determine the weight of the total smelter charge and the weight percent of arsenic, antimony, lead and zinc shall be approved by the Administrator and shall be accurate to within plus or minus ten percent.[30]

(b) The owner or operator of any primary copper smelter subject to the provisions of this subpart shall install and operate:

(1) A continuous monitoring system to monitor and record the opacity of gases discharged into the atmosphere from any dryer. The span of this system shall be set at 80 to 100 percent opacity.

(2) A continuous monitoring system to monitor and record sulfur dioxide emissions discharged into the atmosphere from any roaster, smelting furnace or copper converter subject to § 60.163 (a). The span of this system shall be set at a sulfur dioxide concentration of 0.20 percent by volume.

(i) The continuous monitoring system performance evaluation required under § 60.13(c) shall be completed prior to the initial performance test required under § 60.8. During the performance evaluation, the span of the continuous monitoring system may be set at a sulfur dioxide concentration of 0.15 percent by volume if necessary to maintain the system output between 20 percent and 90 percent of full scale. Upon completion of the continuous monitoring system performance evaluation, the span of the continuous monitoring system shall be set at a sulfur dioxide concentration of 0.20 percent by volume.

(ii) For the purpose of the continuous monitoring system performance evaluation required under § 60.13(c) the reference method referred to under the Field Test for Accuracy (Relative) in Performance Specification 2 of Appendix B to this part shall be Reference Method 6. For the performance evaluation, each concentration measurement shall be of one hour duration. The pollutant gas used to prepare the calibration gas mixtures required under paragraph 2.1, Performance Specification 2 of Appendix B, and for calibration checks under § 60.13 (d), shall be sulfur dioxide.

(c) Six-hour average sulfur dioxide concentrations shall be calculated and recorded daily for the four consecutive 6-hour periods of each operating day. Each six-hour average shall be determined as the arithmetic mean of the appropriate six contiguous one-hour average sulfur dioxide concentrations provided by the continuous monitoring system installed under paragraph (b) of this section.

(d) For the purpose of reports required under § 60.7(c), periods of excess emissions that shall be reported are defined as follows:

(1) Opacity. Any six-minute period during which the average opacity, as measured by the continuous monitoring

system installed under paragraph (b) of this section, exceeds the standard under § 60.164(a).

(2) Sulfur dioxide. Any six-hour period, as described in paragraph (c) of this section, during which the average emissions of sulfur dioxide, as measured by the continuous monitoring system installed under paragraph (b) of this section, exceeds the standard under § 60.163.

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).). 68

§ 60.166 **Test methods and procedures.**

(a) The reference methods in Appendix A to this part, except as provided for in § 60.8(b), shall be used to determine compliance with the standards prescribed in §§ 60.162, 60.163 and 60.164 as follows:

(1) Method 5 for the concentration of particulate matter and the associated moisture content.

(2) Sulfur dioxide concentrations shall be determined using the continuous monitoring system installed in accordance with § 60.165(b). One 6-hour average period shall constitute one run. The monitoring system drift during any run shall not exceed 2 percent of span.

(b) For Method 5, Method 1 shall be used for selecting the sampling site and the number of traverse points, Method 2 for determining velocity and volumetric flow rate and Method 3 for determining the gas analysis. The sampling time for each run shall be at least 60 minutes and the minimum sampling volume shall be 0.85 dscm (30 dscf) except that smaller times or volumes, when necessitated by process variables or other factors, may be approved by the Administrator.

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).). 68

36 FR 24876, 12/23/71 (1)

as amended

41 FR 2332, 1/15/76 (26)
41 FR 8346, 2/26/76 (30)
42 FR 37936, 7/25/77 (64)
42 FR 41424, 8/17/77 (68)

Subpart Q—Standards of Performance for Primary Zinc Smelters [26]

§ 60.170 Applicability and designation of affected facility.[64]

(a) The provisions of this subpart are applicable to the following affected facilities in primary zinc smelters: roaster and sintering machine.

(b) Any facility under paragraph (a) of this section that commences construction or modification after October 16, 1974, is subject to the requirements of this subpart.

§ 60.171 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in subpart A of this part.

(a) "Primary zinc smelter" means any installation engaged in the production, or any intermediate process in the production, of zinc or zinc oxide from zinc sulfide ore concentrates through the use of pyrometallurgical techniques.

(b) "Roaster" means any facility in which a zinc sulfide ore concentrate charge is heated in the presence of air to eliminate a significant portion (more than 10 percent) of the sulfur contained in the charge.

(c) "Sintering machine" means any furnace in which calcines are heated in the presence of air to agglomerate the calcines into a hard porous mass called "sinter."

(d) "Sulfuric acid plant" means any facility producing sulfuric acid by the contact process.

§ 60.172 Standard for particulate matter.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any sintering machine any gases which contain particulate matter in excess of 50 mg/dscm (0.022 gr/dscf).

§ 60.173 Standard for sulfur dioxide.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any roaster any gases which contain sulfur dioxide in excess of 0.065 percent by volume.

(b) Any sintering machine which eliminates more than 10 percent of the sulfur initially contained in the zinc sulfide ore concentrates will be considered as a roaster under paragraph (a) of this section.

§ 60.174 Standard for visible emissions.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any sintering machine any visible emissions which exhibit greater than 20 percent opacity.

(b) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility that uses a sulfuric acid plant to comply with the standard set forth in § 60.173, any visible emissions which exhibit greater than 20 percent opacity.

§ 60.175 Monitoring of operations.

(a) The owner or operator of any primary zinc smelter subject to the provisions of this subpart shall install and operate:

(1) A continuous monitoring system to monitor and record the opacity of gases discharged into the atmosphere from any sintering machine. The span of this system shall be set at 80 to 100 percent opacity.

(2) A continuous monitoring system to monitor and record sulfur dioxide emissions discharged into the atmosphere from any roaster subject to § 60.173. The span of this system shall be set at a sulfur dioxide concentration of 0.20 percent by volume.

(i) The continuous monitoring system performance evaluation required under § 60.13(c) shall be completed prior to the initial performance test required under § 60.8. During the performance evaluation, the span of the continuous monitoring system may be set at a sulfur dioxide concentration of 0.15 percent by volume if necessary to maintain the system output between 20 percent and 90 percent of full scale. Upon completion of the continuous monitoring system performance evaluation, the span of the continuous monitoring system shall be set at a sulfur dioxide concentration of 0.20 percent by volume.

(ii) For the purpose of the continuous monitoring system performance evaluation required under § 60.13(c), the reference method referred to under the Field Test for Accuracy (Relative) in Performance Specification 2 of Appendix B to this part shall be Reference Method 6. For the performance evaluation, each concentration measurement shall be of one hour duration. The pollutant gas used to prepare the calibration gas mixtures required under paragraph 2.1, Performance Specification 2 of Appendix B, and for calibration checks under § 60.13(d), shall be sulfur dioxide.

(b) Two-hour average sulfur dioxide concentrations shall be calculated and recorded daily for the twelve consecutive 2-hour periods of each operating day. Each two-hour average shall be determined as the arithmetic mean of the appropriate two contiguous one-hour average sulfur dioxide concentrations provided by the continuous monitoring system installed under paragraph (a) of this section.

(c) For the purpose of reports required under § 60.7(c), periods of excess emissions that shall be reported are defined as follows:

(1) Opacity. Any six-minute period during which the average opacity, as measured by the continuous monitoring system installed under paragraph (a) of this section, exceeds the standard under § 60.174(a).

(2) Sulfur dioxide. Any two-hour period, as described in paragraph (b) of this section, during which the average emissions of sulfur dioxide, as measured by the continuous monitoring system installed under paragraph (a) of this section, exceeds the standard under § 60.173.

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).).[68]

§ 60.176 Test methods and procedures.

(a) The reference methods in Appendix A to this part, except as provided for in § 60.8(b), shall be used to determine compliance with the standards prescribed in §§ 60.172, 60.173 and 60.174 as follows:

(1) Method 5 for the concentration of particulate matter and the associated moisture content.

(2) Sulfur dioxide concentrations shall be determined using the continuous monitoring system installed in accordance with § 60.175(a). One 2-hour average period shall constitute one run.

(b) For Method 5, Method 1 shall be used for selecting the sampling site and the number of traverse points, Method 2 for determining velocity and volumetric flow rate and Method 3 for determining the gas analysis. The sampling time for each run shall be at least 60 minutes and the minimum sampling volume shall be 0.85 dscm (30 dscf) except that smaller times or volumes, when necessitated by process variables or other factors, may be approved by the Administrator.

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).).[68]

36 FR 24876, 12/23/71 (1)
as amended
41 FR 2332, 1/15/76 (26)
42 FR 37936, 7/25/77 (64)
42 FR 41424, 8/17/77 (68)

Subpart R—Standards of Performance for Primary Lead Smelters [26]

§ 60.180 Applicability and designation of affected facility.[64]

(a) The provisions of this subpart are applicable to the following affected facilities in primary lead smelters: sintering machine, sintering machine discharge end, blast furnace, dross reverberatory furnace, electric smelting furnace, and converter.

(b) Any facility under paragraph (a) of this section that commences construction or modification after October 16, 1974, is subject to the requirements of this subpart.

§ 60.181 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in subpart A of this part.

(a) "Primary lead smelter" means any installation or any intermediate process engaged in the production of lead from lead sulfide ore concentrates through the use of pyrometallurgical techniques.

(b) "Sintering machine" means any furnace in which a lead sulfide ore concentrate charge is heated in the presence of air to eliminate sulfur contained in the charge and to agglomerate the charge into a hard porous mass called "sinter."

(c) "Sinter bed" means the lead sulfide ore concentrate charge within a sintering machine.

(d) "Sintering machine discharge end" means any apparatus which receives sinter as it is discharged from the conveying grate of a sintering machine.

(e) "Blast furnace" means any reduction furnace to which sinter is charged and which forms separate layers of molten slag and lead bullion.

(f) "Dross reverberatory furnace" means any furnace used for the removal or refining of impurities from lead bullion.

(g) "Electric smelting furnace" means any furnace in which the heat necessary for smelting of the lead sulfide ore concentrate charge is generated by passing an electric current through a portion of the molten mass in the furnace.

(h) "Converter" means any vessel to which lead concentrate or bullion is charged and refined.

(i) "Sulfuric acid plant" means any facility producing sulfuric acid by the contact process.

§ 60.182 Standard for particulate matter.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any blast furnace, dross reverberatory furnace, or sintering machine discharge end any gases which contain particulate matter in excess of 50 mg/dscm (0.022 gr/dscf).

§ 60.183 Standard for sulfur dioxide.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any sintering machine, electric smelting furnace, or converter gases which contain sulfur dioxide in excess of 0.065 percent by volume.

§ 60.184 Standard for visible emissions.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any blast furnace, dross reverberatory furnace, or sintering machine discharge end any visible emissions which exhibit greater than 20 percent opacity.

(b) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility that uses a sulfuric acid plant to comply with the standard set forth in § 60.183, any visible emissions which exhibit greater than 20 percent opacity.

§ 60.185 Monitoring of operations.

(a) The owner or operator of any primary lead smelter subject to the provisions of this subpart shall install and operate:

(1) A continuous monitoring system to monitor and record the opacity of gases discharged into the atmosphere from any blast furnace, dross reverberatory furnace, or sintering machine discharge end. The span of this system shall be set at 80 to 100 percent opacity.

(2) A continuous monitoring system to monitor and record sulfur dioxide emissions discharged into the atmosphere from any sintering machine, electric furnace or converter subject to § 60.183. The span of this system shall be set at a sulfur dioxide concentration of 0.20 percent by volume.

(i) The continuous monitoring system performance evaluation required under § 60.13(c) shall be completed prior to the initial performance test required under § 60.8. During the performance evaluation, the span of the continuous monitoring system may be set at a sulfur dioxide concentration of 0.15 percent by volume if necessary to maintain the system output between 20 percent and 90 percent of full scale. Upon completion of the continuous monitoring system performance evaluation, the span of the continuous monitoring system shall be set at a sulfur dioxide concentration of 0.20 percent by volume.

(ii) For the purpose of the continuous monitoring system performance evaluation required under § 60.13(c), the reference method referred to under the Field Test for Accuracy (Relative) in Performance Specification 2 of Appendix B to this part shall be Reference Method 6. For the performance evaluation, each concentration measurement shall be of one hour duration. The pollutant gases used to prepare the calibration gas mixtures required under paragraph 2.1, Performance Specification 2 of Appendix B, and for calibration checks under § 60.13 (d), shall be sulfur dioxide.

(b) Two-hour average sulfur dioxide concentrations shall be calculated and recorded daily for the twelve consecutive two-hour periods of each operating day. Each two-hour average shall be determined as the arithmetic mean of the appropriate two contiguous one-hour average sulfur dioxide concentrations provided by the continuous monitoring system installed under paragraph (a) of this section.

(c) For the purpose of reports required under § 60.7(c), periods of excess emissions that shall be reported are defined as follows:

(1) Opacity. Any six-minute period during which the average opacity, as measured by the continuous monitoring system installed under paragraph (a) of this section, exceeds the standard under § 60.184(a).

(2) Sulfur dioxide. Any two-hour period, as described in paragraph (b) of this section, during which the average emissions of sulfur dioxide, as measured by the continuous monitoring system installed under paragraph (a) of this section, exceeds the standard under § 60.183.

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c–9).).[68]

§ 60.186 Test methods and procedures.

(a) The reference methods in Appendix A to this part, except as provided for in § 60.8(b), shall be used to determine compliance with the standards prescribed in §§ 60.182, 60.183 and 60.184 as follows:

(1) Method 5 for the concentration of particulate matter and the associated moisture content.

(2) Sulfur dioxide concentrations shall be determined using the continuous monitoring system installed in accordance with § 60.185(a). One 2-hour average period shall constitute one run.

(b) For Method 5, Method 1 shall be used for selecting the sampling site and the number of traverse points, Method 2 for determining velocity and volumetric flow rate and Method 3 for determining the gas analysis. The sampling time for each run shall be at least 60 minutes and the minimum sampling volume shall be 0.85 dscm (30 dscf) except that smaller times or volumes, when necessitated by process variables or other factors, may be approved by the Administrator.

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c–9).).[68]

36 FR 24876, 12/23/71 (1)

as amended

41 FR 2332, 1/15/76 (26)
42 FR 37936, 7/25/77 (64)
42 FR 41424, 8/17/77 (68)

Subpart S—Standards of Performance for Primary Aluminum Reduction Plants[27]

§ 60.190 Applicability and designation of affected facility.[64]

(a) The affected facilities in primary aluminum reduction plants to which this subpart applies are potroom groups and anode bake plants.

(b) Any facility under paragraph (a) of this section that commences construction or modification after October 23, 1974, is subject to the requirements of this subpart.

§ 60.191 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in subpart A of this part.

(a) "Primary aluminum reduction plant" means any facility manufacturing aluminum by electrolytic reduction.

(b) "Anode bake plant" means a facility which produces carbon anodes for use in a primary aluminum reduction plant.

(c) "Potroom" means a building unit which houses a group of electrolytic cells in which aluminum is produced.

(d) "Potroom group" means an uncontrolled potroom, a potroom which is controlled individually, or a group of potrooms ducted to the same control system.

(e) "Roof monitor" means that portion of the roof of a potroom where gases not captured at the cell exit from the potroom.

(f) "Aluminum equivalent" means an amount of aluminum which can be produced from a ton of anodes produced by an anode bake plant as determined by § 60.195(e).

(g) "Total fluorides" means elemental fluorine and all fluoride compounds as measured by reference methods specified in § 60.195 or by equivalent or alternative methods [see § 60.8(b)].

(h) "Primary control system" means an air pollution control system designed to remove gaseous and particulate fluorides from exhaust gases which are captured at the cell.

(i) "Secondary control system" means an air pollution control system designed to remove gaseous and particulate fluorides from gases which escape capture by the primary control system.

§ 60.192 Standard for fluorides.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility any gases which contain total fluorides in excess of:

(1) 1 kg/metric ton (2 lb/ton) of aluminum produced for vertical stud Soderberg and horizontal stud Soderberg plants;

(2) 0.95 kg/metric ton (1.9 lb/ton) of aluminum produced for potroom groups at prebake plants; and

(3) 0.05 kg/metric ton (0.1 lb/ton) of aluminum equivalent for anode bake plants.

§ 60.193 Standard for visible emissions.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere:

(1) From any potroom group any gases which exhibit 10 percent opacity or greater, or

(2) From any anode bake plant any gases which exhibit 20 percent opacity or greater.

§ 60.194 Monitoring of operations.

(a) The owner or operator of any affected facility subject to the provisions of this subpart shall install, calibrate, maintain, and operate monitoring devices which can be used to determine daily the weight of aluminum and anode produced. The weighing devices shall have an accuracy of ±5 percent over their operating range.

(b) The owner or operator of any affected facility shall maintain a record of daily production rates of aluminum and anodes, raw material feed rates, and cell or potline voltages.

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c–9).).[68]

§ 60.195 Test methods and procedures.

(a) Except as provided in § 60.8(b), reference methods specified in Appendix A of this part shall be used to determine compliance with the standards prescribed in § 60.192 as follows:

(1) For sampling emissions from stacks:

(i) Method 13A or 13B for the concentration of total fluorides and the associated moisture content,

(ii) Method 1 for sample and velocity traverses,

(iii) Method 2 for velocity and volumetric flow rate, and

(iv) Method 3 for gas analysis.

(2) For sampling emissions from roof monitors not employing stacks or pollutant collection systems:

(i) Method 14 for the concentration of total fluorides and associated moisture content,

(ii) Method 1 for sample and velocity traverses,

(iii) Method 2 and Method 14 for velocity and volumetric flow rate, and

(iv) Method 3 for gas analysis.

(3) For sampling emissions from roof monitors not employing stacks but equipped with pollutant collection systems, the procedures under § 60.8(b) shall be followed.

(b) For Method 13A or 13B, the sampling time for each run shall be at least eight hours for any potroom sample and at least four hours for any anode bake plant sample, and the minimum sample volume shall be 6.8 dscm (240 dscf) for any potroom sample and 3.4 dscm (120 dscf) for any anode bake plant sample except that shorter sampling times or smaller volumes, when necessitated by process variables or other factors, may be approved by the Administrator.

(c) The air pollution control system for each affected facility shall be constructed so that volumetric flow rates and total fluoride emissions can be accurately determined using applicable methods specified under paragraph (a) of this section.

(d) The rate of aluminum production shall be determined as follows:

(1) Determine the weight of aluminum in metric tons produced during a period from the last tap before a run starts until the first tap after the run ends using a monitoring device which meets the requirements of § 60.194(a).

(2) Divide the weight of aluminum produced by the length of the period in hours.

(e) For anode bake plants, the aluminum equivalent for anodes produced shall be determined as follows:

(1) Determine the average weight (metric tons) of anode produced in the anode bake plant during a representative oven cycle using a monitoring device which meets the requirements of § 60.194(a).

(2) Determine the average rate of anode production by dividing the total weight of anodes produced during the representative oven cycle by the length of the cycle in hours.

(3) Calculate the aluminum equivalent for anodes produced by multiplying the average rate of anode production by two. (Note: an owner or operator may establish a different multiplication factor by submitting production records of the tons of aluminum produced and the concurrent tons of anode consumed by potrooms.)

(f) For each run, potroom group emissions expressed in kg/metric ton of aluminum produced shall be determined using the following equation:

$$E_{pg} = \frac{(C_s Q_s)_1 10^{-6} + (C_s Q_s)_2 10^{-6}}{M}$$

where:

E_{pg}=potroom group emissions of total fluorides in kg/metric ton of aluminum produced.

C_s=concentration of total fluorides in mg/dscm as determined by Method 13A or 13B, or by Method 14, as applicable.

Q_s=volumetric flow rate of the effluent gas stream in dscm/hr as determined by Method 2 and/or Method 14, as applicable.

10^{-6}=conversion factor from mg to kg.

M=rate of aluminum production in metric ton/hr as determined by § 60.195(d).

$(C_s Q_s)_1$=product of C_s and Q_s for measurements of primary control system effluent gas streams.

$(C_s Q_s)_2$=product of C_s and Q_s for measurements of secondary control system or roof monitor effluent gas streams.

(g) For each run, as applicable, anode bake plant emissions expressed in kg/metric ton of aluminum equivalent shall be determined using the following equation:

$$E_{bp} = \frac{C_s Q_{sd} 10^{-6}}{M_e}$$

Where:

E_{bp} = anode bake plant emissions of total fluorides in kg/metric ton of aluminum equivalent.

C_s = concentration of total fluorides in mg/dscm as determined by Method 13A or 13B.

Q_{sd} = volumetric flow rate of the effluent gas stream in dscm/hr as determined by Method 2.

10^{-6} = conversion factor from mg to kg.

M_e = aluminum equivalent for anodes produced by anode bake plants in metric ton/hr as determined by § 60.195(e).

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).). 68

36 FR 24876, 12/23/71 (1)
as amended
41 FR 3825, 1/26/76 (27)
42 FR 37936, 7/25/77 (64)
42 FR 41424, 8/17/77 (68)

Subpart T—Standards of Performance for the Phosphate Fertilizer Industry: Wet-Process Phosphoric Acid Plants[14]

§ 60.200 Applicability and designation of affected facility.[64]

(a) The affected facility to which the provisions of this subpart apply is each wet-process phosphoric acid plant. For the purpose of this subpart, the affected facility includes any combination of: reactors, filters, evaporators, and hotwells.

(b) Any facility under paragraph (a) of this section that commences construction or modification after October 22, 1974, is subject to the requirements of this subpart.

§ 60.201 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in Subpart A of this part.

(a) "Wet-process phosphoric acid plant" means any facility manufacturing phosphoric acid by reacting phosphate rock and acid.

(b) "Total fluorides" means elemental fluorine and all fluoride compounds as measured by reference methods specified in § 60.204, or equivalent or alternative methods.

(c) "Equivalent P_2O_5 feed" means the quantity of phosphorus, expressed as phosphorous pentoxide, fed to the process.

§ 60.202 Standard for fluorides.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility any gases which contain total fluorides in excess of 10.0 g/metric ton of equivalent P_2O_5 feed (0.020 lb/ton).

§ 60.203 Monitoring of operations.

(a) The owner or operator of any wet-process phosphoric acid plant subject to the provisions of this subpart shall install, calibrate, maintain, and operate a monitoring device which can be used to determine the mass flow of phosphorus-bearing feed material to the process. The monitoring device shall have an accuracy of ±5 percent over its operating range.

(b) The owner or operator of any wet-process phosphoric acid plant shall maintain a daily record of equivalent P_2O_5 feed by first determining the total mass rate in metric ton/hr of phosphorus bearing feed using a monitoring device for measuring mass flowrate which meets the requirements of paragraph (a) of this section and then by proceeding according to § 60.204(d)(2).

(c) The owner or operator of any wet-process phosphoric acid subject to the provisions of this part shall install, calibrate, maintain, and operate a monitoring device which continuously measures and permanently records the total pressure drop across the process scrubbing system. The monitoring device shall have an accuracy of ±5 percent over its operating range.

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).).[68]

§ 60.204 Test methods and procedures.

(a) Reference methods in Appendix A of this part, except as provided in § 60.8 (b), shall be used to determine compliance with the standard prescribed in § 60.202 as follows:

(1) Method 13A or 13B for the concentration of total fluorides and the associated moisture content,

(2) Method 1 for sample and velocity traverses,

(3) Method 2 for velocity and volumetric flow rate, and

(4) Method 3 for gas analysis.

(b) For Method 13A or 13B, the sampling time for each run shall be at least 60 minutes and the minimum sample volume shall be 0.85 dscm (30 dscf) except that shorter sampling times or smaller volumes, when necessitated by process variables or other factors, may be approved by the Administrator.

(c) The air pollution control system for the affected facility shall be constructed so that volumetric flow rates and total fluoride emissions can be accurately determined by applicable test methods and procedures.

(d) Equivalent P_2O_5 feed shall be determined as follows:

(1) Determine the total mass rate in metric ton/hr of phosphorus-bearing feed during each run using a flow monitoring device meeting the requirements of § 60.203(a).

(2) Calculate the equivalent P_2O_5 feed by multiplying the percentage P_2O_5 content, as measured by the spectrophotometric molybdovanadophosphate method (AOAC Method 9), times the total mass rate of phosphorus-bearing feed. AOAC Method 9 is published in the Official Methods of Analysis of the Association of Official Analytical Chemists, 11th edition, 1970, pp. 11–12. Other methods may be approved by the Administrator.

(e) For each run, emissions expressed in g/metric ton of equivalent P_2O_5 feed shall be determined using the following equation:

$$E=\frac{(C_s Q_s)\ 10^{-3}}{M_{P_2O_5}}$$

where:

E=Emissions of total fluorides in g/metric ton of equivalent P_2O_5 feed.

C_s=Concentration of total fluorides in mg/dscm as determined by Method 13A or 13B.

Q_s=Volumetric flow rate of the effluent gas stream in dscm/hr as determined by Method 2.

10^{-3}=Conversion factor for mg to g.

$M_{P_2O_5}$=Equivalent P_2O_5 feed in metric ton/hr as determined by § 60.204(d).

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).).[68]

36 FR 24876, 12/23/71 (1)

as amended

40 FR 33152, 8/6/75 (14)
42 FR 37936, 7/25/77 (64)
42 FR 41424, 8/17/77 (68)

Subpart U—Standards of Performance for the Phosphate Fertilizer Industry: Superphosphoric Acid Plants [14]

§ 60.210 Applicability and designation of affected facility.[64]

(a) The affected facility to which the provisions of this subpart apply is each superphosphoric acid plant. For the purpose of this subpart, the affected facility includes any combination of: evaporators, hotwells, acid sumps, and cooling tanks.

(b) Any facility under paragraph (a) of this section that commences construction or modification after October 22, 1974, is subject to the requirements of this subpart.

§ 60.211 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in subpart A of this part.

(a) "Superphosphoric acid plant" means any facility which concentrates wet-process phosphoric acid to 66 percent or greater P_2O_5 content by weight for eventual consumption as a fertilizer.

(b) "Total fluorides" means elemental fluorine and all fluoride compounds as measured by reference methods specified in § 60.214, or equivalent or alternative methods.

(c) "Equivalent P_2O_5 feed" means the quantity of phosphorus, expressed as phosphorous pentoxide, fed to the process.

§ 60.212 Standard for fluorides.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility any gases which contain total fluorides in excess of 5.0 g/metric ton of equivalent P_2O_5 feed (0.010 lb/ton).

§ 60.213 Monitoring of operations.

(a) The owner or operator of any superphosphoric acid plant subject to the provisions of this subpart shall install, calibrate, maintain, and operate a flow monitoring device which can be used to determine the mass flow of phosphorus-bearing feed material to the process. The flow monitoring device shall have an accuracy of ± 5 percent over its operating range.

(b) The owner or operator of any superphosphoric acid plant shall maintain a daily record of equivalent P_2O_5 feed by first determining the total mass rate in metric ton/hr of phosphorus-bearing feed using a flow monitoring device meeting the requirements of paragraph (a) of this section and then by proceeding according to § 60.214(d)(2).

(c) The owner or operator of any superphosphoric acid plant subject to the provisions of this part shall install, calibrate, maintain, and operate a monitoring device which continuously measures and permanently records the total pressure drop across the process scrubbing system. The monitoring device shall have an accuracy of ± 5 percent over its operating range.

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).). 68

§ 60.214 Test methods and procedures.

(a) Reference methods in Appendix A of this part, except as provided in § 60.8(b), shall be used to determine compliance with the standard prescribed in § 60.212 as follows:

(1) Method 13A or 13B for the concentration of total fluorides and the associated moisture content.

(2) Method 1 for sample and velocity traverses,

(3) Method 2 for velocity and volumetric flow rate, and

(4) Method 3 for gas analysis.

(b) For Method 13A or 13B, the sampling time for each run shall be at least 60 minutes and the minimum sample volume shall be at least 0.85 dscm (30 dscf) except that shorter sampling times or smaller volumes, when necessitated by process variables or other factors, may be approved by the Administrator.

(c) The air pollution control system for the affected facility shall be constructed so that volumetric flow rates and total fluoride emissions can be accurately determined by applicable test methods and procedures.

(d) Equivalent P_2O_5 feed shall be determined as follows:

(1) Determine the total mass rate in metric ton/hr of phosphorus-bearing feed during each run using a flow monitoring device meeting the requirements of § 60.213(a).

(2) Calculate the equivalent P_2O_5 feed by multiplying the percentage P_2O_5 content, as measured by the spectrophotometric molybdovanadophosphate method (AOAC Method 9), times the total mass rate of phosphorus-bearing feed. AOAC Method 9 is published in the Official Methods of Analysis of the Association of Official Analytical Chemists, 11th edition, 1970, pp. 11–12. Other methods may be approved by the Administrator.

(e) For each run, emissions expressed in g/metric ton of equivalent P_2O_5 feed, shall be determined using the following equation:

$$E=\frac{(C_sQ_s)\ 10^{-3}}{M_{P_2O_5}}$$

where:

E = Emissions of total fluorides in g/metric ton of equivalent P_2O_5 feed.

C_s = Concentration of total fluorides in mg/dscm as determined by Method 13A or 13B.

Q_s = Volumetric flow rate of the effluent gas stream in dscm/hr as determined by Method 2.

10^{-3} = Conversion factor for mg to g.

$M_{P_2O_5}$ = Equivalent P_2O_5 feed in metric ton/hr as determined by § 60.214(d).

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).). 68

36 FR 24876, 12/23/71 (1)
as amended
40 FR 33152, 8/6/75 (14)
42 FR 37936, 7/25/77 (64)
42 FR 41424, 8/17/77 (68)

Subpart V—Standards of Performance for the Phosphate Fertilizer Industry: Diammonium Phosphate Plants[14]

§ 60.220 Applicability and designation of affected facility.[64]

(a) The affected facility to which the provisions of this subpart apply is each granular diammonium phosphate plant. For the purpose of this subpart, the affected facility includes any combination of: reactors, granulators, dryers, coolers, screens, and mills.

(b) Any facility under paragraph (a) of this section that commences construction or modification after October 22, 1974, is subject to the requirements of this subpart.

§ 60.221 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in subpart A of this part.

(a) "Granular diammonium phosphate plant" means any plant manufacturing granular diammonium phosphate by reacting phosphoric acid with ammonia.

(b) "Total fluorides" means elemental fluorine and all fluoride compounds as measured by reference methods specified in § 60.224, or equivalent or alternative methods.

(c) "Equivalent P_2O_5 feed" means the quantity of phosphorus, expressed as phosphorous pentoxide, fed to the process.

§ 60.222 Standard for fluorides.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility any gases which contain total fluorides in excess of 30 g/metric ton of equivalent P_2O_5 feed (0.060 lb/ton).

§ 60.223 Monitoring of operations.

(a) The owner or operator of any granular diammonium phosphate plant subject to the provisions of this subpart shall install, calibrate, maintain, and operate a flow monitoring device which can be used to determine the mass flow of phosphorus-bearing feed material to the process. The flow monitoring device shall have an accuracy of ±5 percent over its operating range.

(b) The owner or operator of any granular diammonium phosphate plant shall maintain a daily record of equivalent P_2O_5 feed by first determining the total mass rate in metric ton/hr of phosphorus-bearing feed using a flow monitoring device meeting the requirements of paragraph (a) of this section and then by proceeding according to § 60.224(d)(2).

(c) The owner or operator of any granular diammonium phosphate plant subject to the provisions of this part shall install, calibrate, maintain, and operate a monitoring device which continuously measures and permanently records the total pressure drop across the scrubbing system. The monitoring device shall have an accuracy of ±5 percent over its operating range.

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).).[68]

§ 60.224 Test methods and procedures.

(a) Reference methods in Appendix A of this part, except as provided for in § 60.8(b), shall be used to determine compliance with the standard prescribed in § 60.222 as follows:

(1) Method 13A or 13B for the concentration of total fluorides and the associated moisture content,

(2) Method 1 for sample and velocity traverses,

(3) Method 2 for velocity and volumetric flow rate, and

(4) Method 3 for gas analysis.

(b) For Method 13A or 13B, the sampling time for each run shall be at least 60 minutes and the minimum sample volume shall be at least 0.85 dscm (30 dscf) except that shorter sampling times or smaller volumes when necessitated by process variables or other factors, may be approved by the Administrator.

(c) The air pollution control system for the affected facility shall be constructed so that volumetric flow rates and total fluoride emissions can be accurately determined by applicable test methods and procedures.

(d) Equivalent P_2O_5 feed shall be determined as follows:

(1) Determine the total mass rate in metric ton/hr of phosphorus-bearing feed during each run using a flow monitoring device meeting the requirements of § 60.223(a).

(2) Calculate the equivalent P_2O_5 feed by multiplying the percentage P_2O_5 content, as measured by the spectrophotometric molybdovanadophosphate method (AOAC Method 9), times the total mass rate of phosphorus-bearing feed. AOAC Method 9 is published in the Official Methods of Analysis of the Association of Official Analytical Chemists, 11th edition, 1970, pp. 11–12. Other methods may be approved by the Administrator.

(e) For each run, emissions expressed in g/metric ton of equivalent P_2O_5 feed shall be determined using the following equation:

$$E=\frac{(C_s Q_s)\ 10^{-3}}{M_{P_2O_5}}$$

where:

E = Emissions of total fluorides in g/metric ton of equivalent P_2O_5.

C_s = Concentration of total fluorides in mg/dscm as determined by Method 13A or 13B.

Q_s = Volumetric flow rate of the effluent gas stream in dscm/hr as determined by Method 2.

10^{-3} = Conversion factor for mg to g.

$M_{P_2O_5}$ = Equivalent P_2O_5 feed in metric ton/hr as determined by § 60.224(d).

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).).[68]

36 FR 24876, 12/23/71 (1)

as amended

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42 FR 37936, 7/25/77 (64)
42 FR 41424, 8/17/77 (68)

Subpart W—Standards of Performance for the Phosphate Fertilizer Industry: Triple Superphosphate Plants [14]

§ 60.230 Applicability and designation of affected facility.[64]

(a) The affected facility to which the provisions of this subpart apply is each triple superphosphate plant. For the purpose of this subpart, the affected facility includes any combination of: mixers, curing belts (dens), reactors, granulators, dryers, cookers, screens, mills, and facilities which store run-of-pile triple superphosphate.

(b) Any facility under paragraph (a) of this section that commences construction or modification after October 22, 1974, is subject to the requirements of this subpart.

§ 60.231 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in subpart A of this part.

(a) "Triple superphosphate plant" means any facility manufacturing triple superphosphate by reacting phosphate rock with phosphoric acid. A rule-of-pile triple superphosphate plant includes curing and storing.

(b) "Run-of-pile triple superphosphate" means any triple superphosphate that has not been processed in a granulator and is composed of particles at least 25 percent by weight of which (when not caked) will pass through a 16 mesh screen.

(c) "Total fluorides" means elemental fluorine and all fluoride compounds as measured by reference methods specified in § 60.234, or equivalent or alternative methods.

(d) "Equivalent P_2O_5 feed" means the quantity of phosphorus, expressed as phosphorus pentoxide, fed to the process.

§ 60.232 Standard for fluorides.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility any gases which contain total fluorides in excess of 100 g/metric ton of equivalent P_2O_5 feed (0.20 lb/ton).

§ 60.233 Monitoring of operations.

(a) The owner or operator of any triple superphosphate plant subject to the provisions of this subpart shall install, calibrate, maintain, and operate a flow monitoring device which can be used to determine the mass flow of phosphorus-bearing feed material to the process. The flow monitoring device shall have an accuracy of ±5 percent over its operating range.

(b) The owner or operator of any triple superphosphate plant shall maintain a daily record of equivalent P_2O_5 feed by first determining the total mass rate in metric ton/hr of phosphorus-bearing feed using a flow monitoring device meeting the requirements of paragraph (a) of this section and then by proceeding according to § 60.234(d)(2).

(c) The owner or operator of any triple superphosphate plant subject to the provisions of this part shall install, calibrate, maintain, and operate a monitoring device which continuously measures and permanently records the total pressure drop across the process scrubbing system. The monitoring device shall have an accuracy of ±5 percent over its operating range.

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).).[68]

§ 60.234 Test methods and procedures.

(a) Reference methods in Appendix A of this part, except as provided for in § 60.8(b), shall be used to determine compliance with the standard prescribed in § 60.232 as follows:

(1) Method 13A or 13B for the concentration of total fluorides and the associated moisture content,

(2) Method 1 for sample and velocity traverses,

(3) Method 2 for velocity and volumetric flow rate, and

(4) Method 3 for gas analysis.

(b) For Method 13A or 13B, the sampling time for each run shall be at least 60 minutes and the minimum sample volume shall be at least 0.85 dscm (30 dscf) except that shorter sampling times or smaller volumes, when necessitated by process variables or other factors, may be approved by the Administrator.

(c) The air pollution control system for the affected facility shall be constructed so that volumetric flow rates and total fluoride emissions can be accurately determined by applicable test methods and procedures.

(d) Equivalent P_2O_5 feed shall be determined as follows:

(1) Determine the total mass rate in metric ton/hr of phosphorus-bearing feed during each run using a flow monitoring device meeting the requirements of § 60.233(a).

(2) Calculate the equivalent P_2O_5 feed by multiplying the percentage P_2O_5 content, as measured by the spectrophotometric molybdovanadophosphate method (AOAC Method 9), times the total mass rate of phosphorus-bearing feed. AOAC Method 9 is published in the Official Methods of Analysis of the Association of Official Analytical Chemists, 11th edition, 1970, pp. 11–12. Other methods may be approved by the Administrator.

(e) For each run, emissions expressed in g/metric ton of equivalent P_2O_5 feed shall be determined using the following equation:

$$E=\frac{(C_s Q_s)\ 10^{-3}}{M_{P_2O_5}}$$

where:

E = Emissions of total fluorides in g/metric ton of equivalent P_2O_5 feed.

C_s = Concentration of total fluorides in mg/dscm as determined by Method 13A or 13B.

Q_s = Volumetric flow rate of the effluent gas stream in dscm/hr as determined by Method 2.

10^{-3} = Conversion factor for mg to g.

$M_{P_2O_5}$ = Equivalent P_2O_5 feed in metric ton/hr as determined by § 60.234(d).

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).).[68]

36 FR 24876, 12/23/71 (1)

as amended

40 FR 33152, 8/6/75 (14)
42 FR 37936, 7/25/77 (64)
42 FR 41424, 8/17/77 (68)

Subpart X—Standards of Performance for the Phosphate Fertilizer Industry: Granular Triple Superphosphate Storage Facilities [14]

§ 60.240 Applicability and designation of affected facility.[64]

(a) The affected facility to which the provisions of this subpart apply is each granular triple superphosphate storage facility. For the purpose of this subpart, the affected facility includes any combination of: storage or curing piles, conveyors, elevators, screens, and mills.

(b) Any facility under paragraph (a) of this section that commences construction or modification after October 22, 1974, is subject to the requirements of this subpart.

§ 60.241 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in subpart A of this part.

(a) "Granular triple superphosphate storage facility" means any facility curing or storing granular triple superphosphate.

(b) "Total fluorides" means elemental fluorine and all fluoride compounds as measured by reference methods specified in § 60.244, or equivalent or alternative methods.

(c) "Equivalent P_2O_5 stored" means the quantity of phosphorus, expressed as phosphorus pentoxide, being cured or stored in the affected facility.

(d) "Fresh granular triple superphosphate" means granular triple superphosphate produced no more than 10 days prior to the date of the performance test.

§ 60.242 Standard for fluorides.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility any gases which contain total fluorides in excess of 0.25 g/hr/metric ton of equivalent P_2O_5 stored (5.0×10^{-4} lb/hr/ton of equivalent P_2O_5 stored).

§ 60.243 Monitoring of operations.

(a) The owner or operator of any granular triple superphosphate storage facility subject to the provisions of this subpart shall maintain an accurate account of triple superphosphate in storage to permit the determination of the amount of equivalent P_2O_5 stored.

(b) The owner or operator of any granular triple superphosphate storage facility shall maintain a daily record of total equivalent P_2O_5 stored by multiplying the percentage P_2O_5 content, as determined by § 60.244(f)(2), times the total mass of granular triple superphosphate stored.

(c) The owner or operator of any granular triple superphosphate storage facility subject to the provisions of this part shall install, calibrate, maintain, and operate a monitoring device which continuously measures and permanently records the total pressure drop across the process scrubbing sytem. The monitoring device shall have an accuracy of ±5 percent over its operating range.

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).).[68]

§ 60.244 Test methods and procedures.

(a) Reference methods in Appendix A of this part, except as provided for in § 60.8(b), shall be used to determine compliance with the standard prescribed in § 60.242 as follows:

(1) Method 13A or 13B for the concentration of total fluorides and the associated moisture content,

(2) Method 1 for sample and velocity traverses,

(3) Method 2 for velocity and volumetric flow rate, and

(4) Method 3 for gas analysis.

(b) For Method 13A or 13B, the sampling time for each run shall be at least 60 minutes and the minimum sample volume shall be at least 0.85 dscm (30 dscf) except that shorter sampling times or smaller volumes, when necessitated by process variables or other factors, may be approved by the Administrator.

(c) The air pollution control system for the affected facility shall be constructed so that volumetric flow rates and total fluoride emissions can be accurately determined by applicable test methods and procedures.

(d) Except as provided under paragraph (e) of this section, all performance tests on granular triple superphosphate storage facilities shall be conducted only when the following quantities of product are being cured or stored in the facility:

(1) Total granular triple superphosphate—at least 10 percent of the building capacity.

(2) Fresh granular triple superphosphate—at least 20 percent of the amount of triple superphosphate in the building.

(e) If the provisions set forth in paragraph (d)(2) of this section exceed production capabilities for fresh granular triple superphosphate, the owner or operator shall have at least five days maximum production of fresh granular triple superphosphate in the building during a performance test.

(f) Equivalent P_2O_5 stored shall be determined as follows:

(1) Determine the total mass stored during each run using an accountability system meeting the requirements of § 60.243(a).

(2) Calculate the equivalent P_2O_5 stored by multiplying the percentage P_2O_5 content, as measured by the spectrophotometric molybdovanadophosphate method (AOAC Method 9), times the total mass stored. AOAC Method 9 is published in the Official Methods of Analysis of the Association of Official Analytical Chemists, 11th edition, 1970, pp. 11–12. Other methods may be approved by the Administrator.

(g) For each run, emissions expressed in g/hr/metric ton of equivalent P_2O_5 stored shall be determined using the following equation:

$$E=\frac{(C_sQ_s)\,10^{-3}}{M_{P_2O_5}}$$

where:

E = Emissions of total fluorides in g/hr/metric ton of equivalent P_2O_5 stored.

C_s = Concentration of total fluorides in mg/dscm as determined by Method 13A or 13B.

Q_s = Volumetric flow rate of the effluent gas stream in dscm/hr as determined by Method 2.

10^{-3} = Conversion factor for mg to g.

$M_{P_2O_5}$ = Equivalent P_2O_5 feed in metric tons as measured by § 60.244(d).

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).).[68]

36 FR 24876, 12/23/71 (1)

as amended

40 FR 33152, 8/6/75 (14)
42 FR 37936, 7/25/77 (64)
42 FR 41424, 8/17/77 (68)

Subpart Y—Standards of Performance for Coal Preparation Plants [26]

§ 60.250 Applicability and designation of affected facility.[64]

(a) The provisions of this subpart are applicable to any of the following affected facilities in coal preparation plants which process more than 200 tons per day: thermal dryers, pneumatic coal-cleaning equipment (air tables), coal processing and conveying equipment (including breakers and crushers), coal storage systems, and coal transfer and loading systems.

(b) Any facility under paragraph (a) of this section that commences construction or modification after October 24, 1974, is subject to the requirements of this subpart.[71]

§ 60.251 Definitions.

As used in this subpart, all terms not defined herein have the meaning given them in the Act and in subpart A of this part.

(a) "Coal preparation plant" means any facility (excluding underground mining operations) which prepares coal by one or more of the following processes: breaking, crushing, screening, wet or dry cleaning, and thermal drying.

(b) "Bituminous coal" means solid fossil fuel classified as bituminous coal by A.S.T.M. Designation D-388-66.

(c) "Coal" means all solid fossil fuels classified as anthracite, bituminous, subbituminous, or lignite by A.S.T.M. Designation D-388-66.

(d) "Cyclonic flow" means a spiraling movement of exhaust gases within a duct or stack.

(e) "Thermal dryer" means any facility in which the moisture content of bituminous coal is reduced by contact with a heated gas stream which is exhausted to the atmosphere.

(f) "Pneumatic coal-cleaning equipment" means any facility which classifies bituminous coal by size or separates bituminous coal from refuse by application of air stream(s).

(g) "Coal processing and conveying equipment" means any machinery used to reduce the size of coal or to separate coal from refuse, and the equipment used to convey coal to or remove coal and refuse from the machinery. This includes, but is not limited to, breakers, crushers, screens, and conveyor belts.

(h) "Coal storage system" means any facility used to store coal except for open storage piles.

(i) "Transfer and loading system" means any facility used to transfer and load coal for shipment.

§ 60.252 Standards for particulate matter.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, an owner or operator subject to the provisions of this subpart shall not cause to be discharged into the atmosphere from any thermal dryer gases which:

(1) Contain particulate matter in excess of 0.070 g/dscm (0.031 gr/dscf).

(2) Exhibit 20 percent opacity or greater.

(b) On and after the date on which the performance test required to be conducted by § 60.8 is completed, an owner or operator subject to the provisions of this subpart shall not cause to be discharged into the atmosphere from any pneumatic coal cleaning equipment, gases which:

(1) Contain particulate matter in excess of 0.040 g/dscm (0.018 gr/dscf).

(2) Exhibit 10 percent opacity or greater.

(c) On and after the date on which the performance test required to be conducted by § 60.8 is completed, an owner or operator subject to the provisions of this subpart shall not cause to be discharged into the atmosphere from any coal processing and conveying equipment, coal storage system, or coal transfer and loading system processing coal, gases which exhibit 20 percent opacity or greater.

§ 60.253 Monitoring of operations.

(a) The owner or operator of any thermal dryer shall install, calibrate, maintain, and continuously operate monitoring devices as follows:

(1) A monitoring device for the measurement of the temperature of the gas stream at the exit of the thermal dryer on a continuous basis. The monitoring device is to be certified by the manufacturer to be accurate within ±3° Fahrenheit.

(2) For affected facilities that use venturi scrubber emission control equipment:

(i) A monitoring device for the continuous measurement of the pressure loss through the venturi constriction of the control equipment. The monitoring device is to be certified by the manufacturer to be accurate within ±1 inch water gage.

(ii) A monitoring device for the continuous measurement of the water supply pressure to the control equipment. The monitoring device is to be certified by the manufacturer to be accurate within ±5 percent of design water supply pressure. The pressure sensor or tap must be located close to the water discharge point. The Administrator may be consulted for approval of alternative locations.

(b) All monitoring devices under paragraph (a) of this section are to be recalibrated annually in accordance with procedures under § 60.13(b)(3) of this part.

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).).[68]

§ 60.254 Test methods and procedures.

(a) The reference methods in Appendix A of this part, except as provided in § 60.8(b), are used to determine compliance with the standards prescribed in § 60.252 as follows:

(1) Method 5 for the concentration of particulate matter and associated moisture content,

(2) Method 1 for sample and velocity traverses,

(3) Method 2 for velocity and volumetric flow rate, and

(4) Method 3 for gas analysis.

(b) For Method 5, the sampling time for each run is at least 60 minutes and the minimum sample volume is 0.85 dscm (30 dscf) except that shorter sampling times or smaller volumes, when necessitated by process variables or other factors, may be approved by the Administrator. Sampling is not to be started until 30 minutes after start-up and is to be terminated before shutdown procedures commence. The owner or operator of the affected facility shall eliminate cyclonic flow during performance tests in a manner acceptable to the Administrator.

(c) The owner or operator shall construct the facility so that particulate emissions from thermal dryers or pneumatic coal cleaning equipment can be accurately determined by applicable test methods and procedures under paragraph (a) of this section.

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).).[68]

36 FR 24876, 12/23/71 (1)
as amended
41 FR 2231, 1/15/76 (26)
42 FR 37936, 7/25/77 (64)
42 FR 41424, 8/17/77 (68)
42 FR 44812, 9/7/77 (71)

Subpart Z—Standards of Performance for Ferroalloy Production Facilities[33,35]

§ 60.260 Applicability and designation of affected facility.[64]

(a) The provisions of this subpart are applicable to the following affected facilities: electric submerged arc furnaces which produce silicon metal, ferrosilicon, calcium silicon, silicomanganese zirconium, ferrochrome silicon, silvery iron, high-carbon ferrochrome, charge chrome, standard ferromanganese, silicomanganese, ferromanganese silicon, or calcium carbide; and dust-handling equipment.[35]

(b) Any facility under paragraph (a) of this section that commences construction or modification after October 21, 1974, is subject to the requirements of this subpart.

§ 60.261 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in subpart A of this part.

(a) "Electric submerged arc furnace" means any furnace wherein electrical energy is converted to heat energy by transmission of current between electrodes partially submerged in the furnace charge.

(b) "Furnace charge" means any material introduced into the electric submerged arc furnace and may consist of, but is not limited to, ores, slag, carbonaceous material, and limestone.

(c) "Product change" means any change in the composition of the furnace charge that would cause the electric submerged arc furnace to become subject to a different mass standard applicable under this subpart.

(d) "Slag" means the more or less completely fused and vitrified matter separated during the reduction of a metal from it's ore.

(e) "Tapping" means the removal of slag or product from the electric submerged arc furnace under normal operating conditions such as removal of metal under normal pressure and movement by gravity down the spout into the ladle.

(f) "Tapping period" means the time duration from initiation of the process of opening the tap hole until plugging of the tap hole is complete.

(g) "Furnace cycle" means the time period from completion of a furnace product tap to the completion of the next consecutive product tap.

(h) "Tapping station" means that general area where molten product or slag is removed from the electric submerged arc furnace.

(i) "Blowing tap" means any tap in which an evolution of gas forces or projects jets of flame or metal sparks beyond the ladle, runner, or collection hood.[35]

(j) "Furnace power input" means the resistive electrical power consumption of an electric submerged arc furnace as measured in kilowatts.

(k) "Dust-handling equipment" means any equipment used to handle particulate matter collected by the air pollution control device (and located at or near such device) serving any electric submerged arc furnace subject to this subpart.

(l) "Control device" means the air pollution control equipment used to remove particulate matter generated by an electric submerged arc furnace from an effluent gas stream.

(m) "Capture system" means the equipment (including hoods, ducts, fans, dampers, etc.) used to capture or transport particulate matter generated by an affected electric submerged arc furnace to the control device.

(n) "Standard ferromanganese" means that alloy as defined by A.S.T.M. designation A99–66.

(o) "Silicomanganese" means that alloy as defined by A.S.T.M. designation A483–66.

(p) "Calcium carbide" means material containing 70 to 85 percent calcium carbide by weight.

(q) "High-carbon ferrochrome" means that alloy as defined by A.S.T.M. designation A101–66 grades HC1 through HC6.

(r) "Charge chrome" means that alloy containing 52 to 70 percent by weight chromium, 5 to 8 percent by weight carbon, and 3 to 6 percent by weight silicon.

(s) "Silvery iron" means any ferrosilicon, as defined by A.S.T.M. designation 100–69, which contains less than 30 percent silicon.

(t) "Ferrochrome silicon" means that alloy as defined by A.S.T.M. designation A482–66.

(u) "Silicomanganese zirconium" means that alloy containing 60 to 65 percent by weight silicon, 1.5 to 2.5 percent by weight calcium, 5 to 7 percent by weight zirconium, 0.75 to 1.25 percent by weight aluminum, 5 to 7 percent by weight manganese, and 2 to 3 percent by weight barium.

(v) "Calcium silicon" means that alloy as defined by A.S.T.M. designation A495–64.

(w) "Ferrosilicon" means that alloy as defined by A.S.T.M. designation A100–69 grades A, B, C, D, and E which contains 50 or more percent by weight silicon.

(x) "Silicon metal" means any silicon alloy containing more than 96 percent silicon by weight.

(y) "Ferromanganese silicon" means that alloy containing 63 to 66 percent by weight manganese, 28 to 32 percent by weight silicon, and a maximum of 0.08 percent by weight carbon.

§ 60.262 Standard for particulate matter.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any electric submerged arc furnace any gases which:

(1) Exit from a control device and contain particulate matter in excess of 0.45 kg/MW-hr (0.99 lb/MW-hr) while silicon metal, ferrosilicon, calcium silicon, or silicomanganese zirconium is being produced.

(2) Exit from a control device and contain particulate matter in excess of 0.23 kg/MW-hr (0.51 lb/MW-hr) while high-carbon ferrochrome, charge chrome, standard ferromanganese, silicomanganese, calcium carbide, ferrochrome silicon, ferromanganese silicon, or silvery iron is being produced.

(3) Exit from a control device and exhibit 15 percent opacity or greater.

(4) Exit from an electric submerged arc furnace and escape the capture system and are visible without the aid of instruments. The requirements under this subparagraph apply only during periods when flow rates are being established under § 60.265(d).

(5) Escape the capture system at the tapping station and are visible without the aid of instruments for more than 40 percent of each tapping period. There are no limitations on visible emissions under this subparagraph when a blowing tap occurs. The requirements under this subparagraph apply only during periods when flow rates are being established under § 60.265(d).

(b) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any dust-handling equipment any gases which exhibit 10 percent opacity or greater.

§ 60.263 Standard for carbon monoxide.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any electric submerged arc furnace any gases which contain, on a dry basis, 20 or greater volume percent of carbon monoxide. Combustion of such gases under conditions acceptable to the Administrator constitutes compliance with this section. Acceptable conditions include, but are not limited to, flaring of gases or use of gases as fuel for other processes.

§ 60.264 Emission monitoring.

(a) The owner or operator subject to the provisions of this subpart shall install, calibrate, maintain and operate a continuous monitoring system for measurement of the opacity of emissions discharged into the atmosphere from the control device(s).

(b) For the purpose of reports required under § 60.7(c), the owner or operator shall report as excess emissions all six-minute periods in which the average opacity is 15 percent or greater.

(c) The owner or operator subject to the provisions of this subpart shall submit a written report of any product change to the Administrator. Reports of product changes must be postmarked not later than 30 days after implementation of the product change.

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).).[66]

§ 60.265 Monitoring of operations.

(a) The owner or operator of any electric submerged arc furnace subject to the provisions of this subpart shall maintain daily records of the following information:

(1) Product being produced.

(2) Description of constituents of furnace charge, including the quantity, by weight.

(3) Time and duration of each tapping period and the identification of material tapped (slag or product.)

(4) All furnace power input data obtained under paragraph (b) of this section.

(5) All flow rate data obtained under paragraph (c) of this section or all fan motor power consumption and pressure drop data obtained under paragraph (e) of this section.

(b) The owner or operator subject to the provisions of this subpart shall install, calibrate, maintain, and operate a device to measure and continuously record the furnace power input. The furnace power input may be measured at the output or input side of the transformer. The device must have an accuracy of ±5 percent over its operating range.

(c) The owner or operator subject to the provisions of this subpart shall install, calibrate, and maintain a monitoring device that continuously measures and records the volumetric flow rate through each separately ducted hood of the capture system, except as provided under paragraph (e) of this section. The owner or operator of an electric submerged arc furnace that is equipped with a water cooled cover which is designed to contain and prevent escape of the generated gas and particulate matter shall monitor only the volumetric flow rate through the capture system for control of emissions from the tapping station. The owner or operator may install the monitoring device(s) in any appropriate location in the exhaust duct such that reproducible flow rate monitoring will result. The flow rate monitoring device must have an accuracy of ±10 percent over its normal operating range and must be calibrated according to the manufacturer's instructions. The Administrator may require the owner or operator to demonstrate the accuracy of the monitoring device relative to Methods 1 and 2 of Appendix A to this part.

(d) When performance tests are conducted under the provisions of § 60.8 of this part to demonstrate compliance with the standards under §§ 60.262(a) (4) and (5), the volumetric flow rate through each separately ducted hood of the capture system must be determined using the monitoring device required under paragraph (c) of this section. The volumetric flow rates must be determined for furnace power input levels at 50 and 100 percent of the nominal rated capacity of the electric submerged arc furnace. At all times the electric submerged arc furnace is operated, the owner or operator shall maintain the volumetric flow rate at or above the appropriate levels for that furnace power input level determined during the most recent performance test. If emissions due to tapping are captured and ducted separately from emissions of the electric submerged arc furnace, during each tapping period the owner or operator shall maintain the exhaust flow rates through the capture system over the tapping station at or above the levels established during the most recent performance test. Operation at lower flow rates may be considered by the Administrator to be unacceptable operation and maintenance of the affected facility. The owner or operator may request that these flow rates be reestablished by conducting new performance tests under § 60.8 of this part.

(e) The owner or operator may as an alternative to paragraph (c) of this section determine the volumetric flow rate through each fan of the capture system from the fan power consumption, pressure drop across the fan and the fan performance curve. Only data specific to the operation of the affected electric submerged arc furnace are acceptable for demonstration of compliance with the requirements of this paragraph. The owner or operator shall maintain on file a permanent record of the fan performance curve (prepared for a specific temperature) and shall:

(1) Install, calibrate, maintain, and operate a device to continuously measure and record the power consumption of the fan motor (measured in kilowatts), and

(2) Install, calibrate, maintain, and operate a device to continuously measure and record the pressure drop across the fan. The fan power consumption and pressure drop measurements must be synchronized to allow real time comparisons of the data. The monitoring devices must have an accuracy of ±5 percent over their normal operating ranges.

(f) The volumetric flow rate through each fan of the capture system must be determined from the fan power consumption, fan pressure drop, and fan performance curve specified under paragraph (e) of this section, during any performance test required under § 60.8 of this part to demonstrate compliance with the standards under §§ 60.262(a) (4) and (5). The owner or operator shall determine the volumetric flow rate at a representative temperature for furnace power input levels of 50 and 100 percent of the nominal rated capacity of the electric submerged arc furnace. At all times the electric submerged arc furnace is operated, the owner or operator shall maintain the fan power consumption and fan pressure drop at levels such that the volumetric flow rate is at or above the levels established during the most recent performance test for that furnace power input level. If emissions due to tapping are captured and ducted separately from emissions of the electric submerged arc furnace, during each tapping period the owner or operator shall maintain the fan power consumption and fan pressure drop at levels such that the volumetric flow rate is at or above the levels established during the most recent performance test. Operation at lower flow rates may be considered by the Administrator to be unacceptable operation and maintenance of the affected facility. The owner or operator may request that these flow rates be reestablished by conducting new performance tests under § 60.8 of this part. The Administrator may require the owner or operator to verify the fan performance curve by monitoring necessary fan operating parameters and determining the gas volume moved relative to Methods 1 and 2 of Appendix A to this part.

(g) All monitoring devices required under paragraphs (c) and (e) of this section are to be checked for calibration annually in accordance with the procedures under § 60.13(b).

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).)

§ 60.266 Test methods and procedures.

(a) Reference methods in Appendix A of this part, except as provided in § 60.8 (b), shall be used to determine compliance with the standards prescribed in § 60.262 and § 60.263 as follows:

(1) Method 5 for the concentration of particulate matter and the associated moisture content except that the heating systems specified in paragraphs 2.1.2 and 2.1.4 of Method 5 are not to be used when the carbon monoxide content of the gas stream exceeds 10 percent by volume, dry basis.

(2) Method 1 for sample and velocity traverses.

(3) Method 2 for velocity and volumetric flow rate.

(4) Method 3 for gas analysis, including carbon monoxide.

(b) For Method 5, the sampling time for each run is to include an integral number of furnace cycles. The sampling time for each run must be at least 60 minutes and the minimum sample volume must be 1.8 dscm (64 dscf) when sampling emissions from open electric submerged arc furnaces with wet scrubber control devices, sealed electric submerged arc furnaces, or semi-enclosed electric submerged arc furnaces. When sampling emissions from other types of installations, the sampling time for each run must be at least 200 minutes and the minimum sample volume must be 5.7 dscm (200 dscf). Shorter sampling times or smaller sampling volumes, when necessitated by process variables or other factors, may be approved by the Administrator.

(c) During the performance test, the owner or operator shall record the maximum open hood area (in hoods with segmented or otherwise moveable sides) under which the process is expected to be operated and remain in compliance with all standards. Any future operation of the hooding system with open areas in excess of the maximum is not permitted.

(d) The owner or operator shall construct the control device so that volumetric flow rates and particulate matter emissions can be accurately determined by applicable test methods and procedures.

(e) During any performance test required under § 60.8 of this part, the owner or operator shall not allow gaseous diluents to be added to the effluent gas stream after the fabric in an open pressurized fabric filter collector unless the total gas volume flow from the collector is accurately determined and considered in the determination of emissions.

(f) When compliance with § 60.263 is to be attained by combusting the gas stream in a flare, the location of the sampling site for particulate matter is to be upstream of the flare.

(g) For each run, particulate matter emissions, expressed in kg/hr (lb/hr), must be determined for each exhaust stream at which emissions are quantified using the following equation:

$$E_n = C_s Q_s$$

where:

E_n = Emissions of particulate matter in kg/hr (lb/hr).

C_s = Concentration of particulate matter in kg/dscm (lb/dscf) as determined by Method 5.

Q_s = Volumetric flow rate of the effluent gas stream in dscm/hr (dscf/hr) as determined by Method 2.

(h) For Method 5, particulate matter emissions from the affected facility, expressed in kg/MW-hr (lb/MW-hr) must be determined for each run using the following equation:

$$E = \frac{\sum_{n=1}^{N} E_n}{p} \quad 35$$

where:

E = Emissions of particulate from the affected facility, in kg/MW-hr (lb/MW-hr).

N = Total number of exhaust streams at which emissions are quantified.

E_n = Emission of particulate matter from each exhaust stream in kg/hr (lb/hr), as determined in paragraph (g) of this section.

p = Average furnace power input during the sampling period, in megawatts as determined according to § 60.263 (b).

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).). 68

36 FR 24876, 12/23/71 (1)

as amended

41 FR 18498, 5/4/76 (33)
41 FR 20659, 5/20/76 (35)
42 FR 37936, 7/25/77 (64)
42 FR 41424, 8/17/77 (68)

Subpart AA—Standards of Performance for Steel Plants: Electric Arc Furnaces [16]

§ 60.270 Applicability and designation of affected facility.[64]

(a) The provisions of this subpart are applicable to the following affected facilities in steel plants: electric arc furnaces and dust-handling equipment.

(b) Any facility under paragraph (a) of this section that commences construction or modification after October 21, 1974, is subject to the requirements of this subpart.[71]

§ 60.271 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in subpart A of this part.

(a) "Electric arc furnace" (EAF) means any furnace that produces molten steel and heats the charge materials with electric arcs from carbon electrodes. Furnaces from which the molten steel is cast into the shape of finished products, such as in a foundry, are not affected facilities included within the scope of this definition. Furnaces which, as the primary source of iron, continuously feed prereduced ore pellets are not affected facilities within the scope of this definition.

(b) "Dust-handling equipment" means any equipment used to handle particulate matter collected by the control device and located at or near the control device for an EAF subject to this subpart.

(c) "Control device" means the air pollution control equipment used to remove particulate matter generated by an EAF(s) from the effluent gas stream.

(d) "Capture system" means the equipment (including ducts, hoods, fans, dampers, etc.) used to capture or transport particulate matter generated by an EAF to the air pollution control device.

(e) "Charge" means the addition of iron and steel scrap or other materials into the top of an electric arc furnace.

(f) "Charging period" means the time period commencing at the moment an EAF starts to open and ending either three minutes after the EAF roof is returned to its closed position or six minutes after commencement of opening of the roof, whichever is longer.

(g) "Tap" means the pouring of molten steel from an EAF.

(h) "Tapping period" means the time period commencing at the moment an EAF begins to tilt to pour and ending either three minutes after an EAF returns to an upright position or six minutes after commencing to tilt, whichever is longer.

(i) "Meltdown and refining" means that phase of the steel production cycle when charge material is melted and undesirable elements are removed from the metal.

(j) "Meltdown and refining period" means the time period commencing at the termination of the initial charging period and ending at the initiation of the tapping period, excluding any intermediate charging periods.

(k) "Shop opacity" means the arithmetic average of 24 or more opacity observations of emissions from the shop taken in accordance with Method 9 of Appendix A of this part for the applicable time periods.

(l) "Heat time" means the period commencing when scrap is charged to an empty EAF and terminating when the EAF tap is completed.

(m) "Shop" means the building which houses one or more EAF's.

(n) "Direct shell evacuation system" means any system that maintains a negative pressure within the EAF above the slag or metal and ducts these emissions to the control device.

§ 60.272 Standard for particulate matter.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from an electric arc furnace any gases which:

(1) Exit from a control device and contain particulate matter in excess of 12 mg/dscm (0.0052 gr/dscf).

(2) Exit from a control device and exhibit three percent opacity or greater.

(3) Exit from a shop and, due solely to operations of any EAF(s), exhibit greater than zero percent shop opacity except:

(i) Shop opacity greater than zero percent, but less than 20 percent, may occur during charging periods.

(ii) Shop opacity greater than zero percent, but less than 40 percent, may occur during tapping periods.

(iii) Opacity standards under paragraph (a)(3) of this section shall apply only during periods when flow rates and pressures are being established under § 60.274 (c) and (f).

(iv) Where the capture system is operated such that the roof of the shop is closed during the charge and the tap, and emissions to the atmosphere are prevented until the roof is opened after completion of the charge or tap, the shop opacity standards under paragraph (a)(3) of this section shall apply when the roof is opened and shall continue to apply for the length of time defined by the charging and/or tapping periods.

(b) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from dust-handling equipment any gases which exhibit 10 percent opacity or greater.

§ 60.273 Emission monitoring.

(a) A continuous monitoring system for the measurement of the opacity of emissions discharged into the atmosphere from the control device(s) shall be installed, calibrated, maintained, and operated by the owner or operator subject to the provisions of this subpart.

(b) For the purpose of reports under § 60.7(c), periods of excess emissions that shall be reported are defined as all six-minute periods during which the average opacity is three percent or greater.

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).).[68]

§ 60.274 Monitoring of operations.

(a) The owner or operator subject to the provisions of this subpart shall maintain records daily of the following information:

(1) Time and duration of each charge;

(2) Time and duration of each tap;

(3) All flow rate data obtained under paragraph (b) of this section, or equivalent obtained under paragraph (d) of this section; and

(4) All pressure data obtained under paragraph (e) of this section.

(b) Except as provided under paragraph (d) of this section, the owner or operator subject to the provisions of this subpart shall install, calibrate, and maintain a monitoring device that continuously records the volumetric flow rate through each separately ducted hood. The monitoring device(s) may be installed in any appropriate location in the exhaust duct such that reproducible flow rate monitoring will result. The flow rate monitoring device(s) shall have an accuracy of ±10 percent over its normal operating range and shall be calibrated according to the manufacturer's instructions. The Administrator may require the owner or operator to demonstrate the accuracy of the monitoring device(s) relative to Methods 1 and 2 of Appendix A of this part.

(c) When the owner or operator of an EAF is required to demonstrate compliance with the standard under § 60.272 (a)(3) and at any other time the Administrator may require (under section 114 of the Act, as amended), the volumetric flow rate through each separately ducted hood shall be determined during all periods in which the hood is operated for the purpose of capturing emissions from the EAF using the monitoring device under paragraph (b) of this section. The owner or operator may petition the Administrator for reestablishment of these flow rates whenever the owner or operator can demonstrate to the Administrator's satisfaction that the EAF operating conditions upon which the flow rates were previously established are no longer applicable. The flow rates determined during the most recent demonstration of compliance shall be maintained (or may be exceeded) at the appropriate level for each applicable period. Operation at lower flow rates may be considered by the Administrator to be unacceptable operation and maintenance of the affected facility.

(d) The owner or operator may petition the Administrator to approve any alternative method that will provide a continuous record of operation of each emission capture system.

(e) Where emissions during any phase of the heat time are controlled by use of a direct shell evacuation system, the owner or operator shall install, calibrate, and maintain a monitoring device that continuously records the pressure in the free space inside the EAF. The pressure shall be recorded as 15-minute integrated averages. The monitoring device may be installed in any appropriate location in the EAF such that reproducible results will be obtained. The pressure monitoring device shall have an accuracy of ±5 mm of water gauge over its normal operating range and shall be calibrated according to the manufacturer's instructions.

(f) When the owner or operator of an EAF is required to demonstrate compliance with the standard under § 60.272 (a)(3) and at any other time the Administrator may require (under section 114 of the Act, as amended), the pressure in the free space inside the furnace shall be determined during the meltdown and refining period(s) using the monitoring device under paragraph (e) of this section. The owner or operator may petition the Administrator for reestablishment of the 15-minute integrated average pressure whenever the owner or operator can demonstrate to the Administrator's satisfaction that the EAF operating conditions upon which the pressures were previously established are no longer applicable. The pressure determined during the most recent demonstration of compliance shall be maintained at all times the EAF is operating in a meltdown and refining period. Operation at higher pressures may be considered by the Administrator to be unacceptable operation and maintenance of the affected facility.

(g) Where the capture system is designed and operated such that all emissions are captured and ducted to a control device, the owner or operator shall not be subject to the requirements of this section.

(Sec. 114 of the Clean Air Act as amended (42 U.S.C 1857c-9).). 68

§ 60.275 Test methods and procedures.

(a) Reference methods in Appendix A of this part, except as provided under § 60.8(b), shall be used to determine compliance with the standards prescribed under § 60.272 as follows:

(1) Method 5 for concentration of particulate matter and associated moisture content;

(2) Method 1 for sample and velocity traverses;

(3) Method 2 for velocity and volumetric flow rate; and

(4) Method 3 for gas analysis.

(b) For Method 5, the sampling time for each run shall be at least four hours. When a single EAF is sampled, the sampling time for each run shall also include an integral number of heats. Shorter sampling times, when necessitated by process variables or other factors, may be approved by the Administrator. The minimum sample volume shall be 4.5 dscm (160 dscf).

(c) For the purpose of this subpart, the owner or operator shall conduct the demonstration of compliance with 60.272(a)(3) and furnish the Administrator a written report of the results of the test.

(d) During any performance test required under § 60.8 of this part, no gaseous diluents may be added to the effluent gas stream after the fabric in any pressurized fabric filter collector, unless the amount of dilution is separately determined and considered in the determination of emissions.

(e) When more than one control device serves the EAF(s) being tested, the concentration of particulate matter shall be determined using the following equation:

$$C_t=\frac{\sum_{n=1}^{N}(C_sQ_s)_n}{\sum_{n=1}^{N}(Q_s)_n}$$

where:

C_t = concentration of particulate matter in mg/dscm (gr/dscf) as determined by method 5.

N = total number of control devices tested.

Q_s = volumetric flow rate of the effluent gas stream in dscm/hr (dscf/hr) as determined by method 2.

$(C_sQ_s)_n$ or $(Q_s)_n$ = value of the applicable parameter for each control device tested.

(f) Any control device subject to the provisions of this subpart shall be designed and constructed to allow measurement of emissions using applicable test methods and procedures.

(g) Where emissions from any EAF(s) are combined with emissions from facilities not subject to the provisions of this subpart but controlled by a common capture system and control device, the owner or operator may use any of the following procedures during a performance test:

(1) Base compliance on control of the combined emissions.

(2) Utilize a method acceptable to the Administrator which compensates for the emissions from the facilities not subject to the provisions of this subpart.

(3) Any combination of the criteria of paragraphs (g)(1) and (g)(2) of this section.

(h) Where emissions from any EAF(s) are combined with emissions from facilities not subject to the provisions of this subpart, the owner or operator may use any of the following procedures for demonstrating compliance with § 60.272 (a)(3):

(1) Base compliance on control of the combined emissions.

(2) Shut down operation of facilities not subject to the provisions of this subpart.

(3) Any combination of the criteria of paragraphs (h)(1) and (h)(2) of this section.

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).). 68

36 FR 24876, 12/23/71 (1)
as amended
40 FR 43850, 9/23/75 (16)
42 FR 37936, 7/25/77 (64)
42 FR 41424, 8/17/77 (68)
42 FR 44812, 9/7/77 (71)

Appendix A—Reference Methods[8]

The reference methods in this appendix are referred to in § 60.8 (Performance Tests) and § 60.11 (Compliance With Standards and Maintenance Requirements) of 40 CFR Part 60, Subpart A (General Provisions). Specific uses of these reference methods are described in the standards of performance contained in the subparts, beginning with Subpart D. .

Within each standard of performance, a section titled "Test Methods and Procedures" is provided to (1) identify the test methods applicable to the facility subject to the respective standard and (2) identify any special instructions or conditions to be followed when applying a method to the respective facility. Such instructions (for example, establish sampling rates, volumes, or temperatures) are to be used either in addition to, or as a substitute for procedures in a reference method. Similarly, for sources subject to emission monitoring requirements, specific instructions pertaining to any use of a reference method are provided in the subpart or in Appendix B.

Inclusion of methods in this appendix is not intended as an endorsement or denial of their applicability to sources that are not subject to standards of performance. The methods are potentially applicable to other sources; however, applicability should be confirmed by careful and appropriate evaluation of the conditions prevalent at such sources.

The approach followed in the formulation of the reference methods involves specifications for equipment, procedures, and performance. In concept, a performance specification approach would be preferable in all methods because this allows the greatest flexibility to the user. In practice, however, this approach is impractical in most cases because performance specifications cannot be established. Most of the methods described herein, therefore, involve specific equipment specifications and procedures, and only a few methods in this appendix rely on performance criteria.

Minor changes in the reference methods should not necessarily affect the validity of the results and it is recognized that alternative and equivalent methods exist. Section 60.8 provides authority for the Administrator to specify or approve (1) equivalent methods, (2) alternative methods, and (3) minor changes in the methodology of the reference methods. It should be clearly understood that unless otherwise identified all such methods and changes must have prior approval of the Administrator. An owner employing such methods or deviations from the reference methods without obtaining prior approval does so at the risk of subsequent disapproval and retesting with approved methods.

Within the reference methods, certain specific equipment or procedures are recognized as being acceptable or potentially acceptable and are specifically identified in the methods. The items identified as acceptable options may be used without approval but must be identified in the test report. The potentially approvable options are cited as "subject to the approval of the Administrator" or as "or equivalent." Such potentially approvable techniques or alternatives may be used at the discretion of the owner without prior approval. However, detailed descriptions for applying these potentially approvable techniques or alternatives are not provided in the reference methods. Also, the potentially approvable options are not necessarily acceptable in all applications. Therefore, an owner electing to use such potentially approvable techniques or alternatives is responsible for: (1) assuring that the techniques or alternatives are in fact applicable and are properly executed; (2) including a written description of the alternative method in the test report (the written method must be clear and must be capable of being performed without additional instruction, and the degree of detail should be similar to the detail contained in the reference methods); and (3) providing any rationale or supporting data necessary to show the validity of the alternative in the particular application. Failure to meet these requirements can result in the Administrator's disapproval of the alternative.

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METHOD 1—SAMPLE AND VELOCITY TRAVERSES FOR STATIONARY SOURCES 69

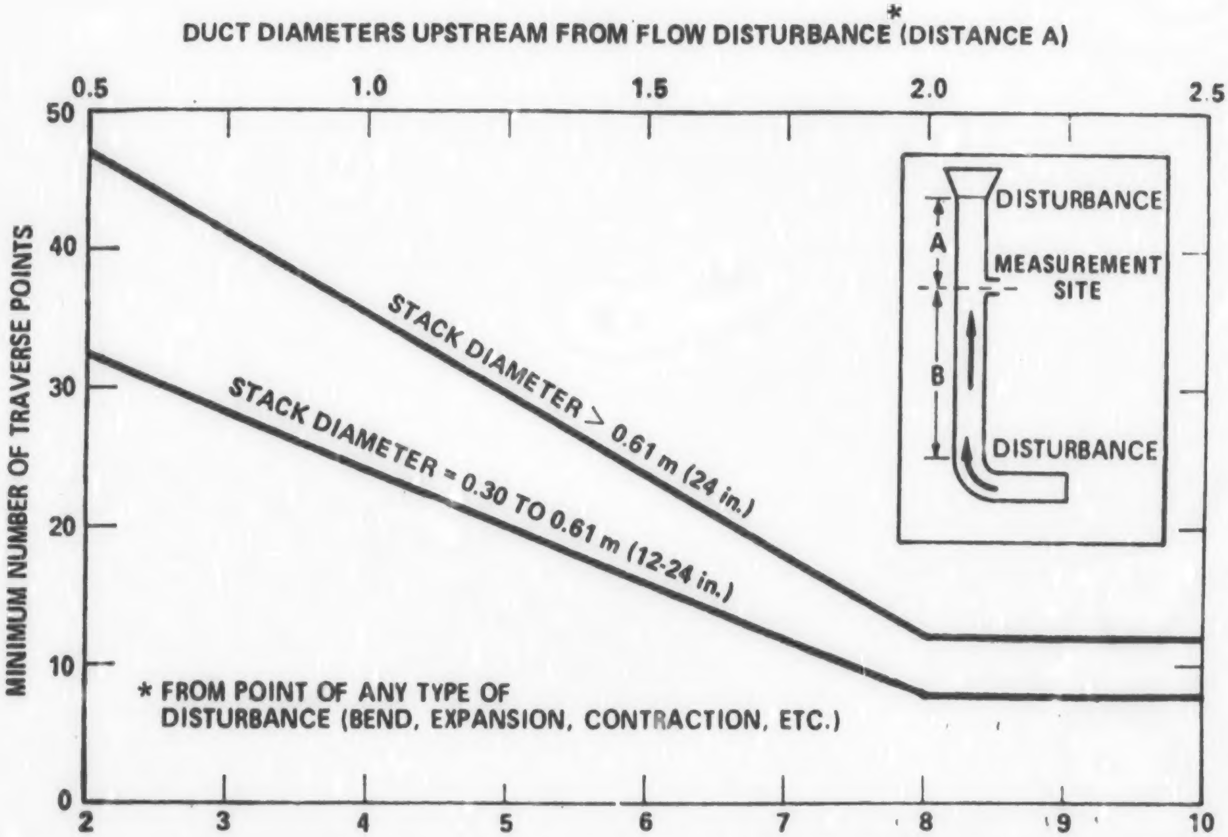

Figure 1-1. Minimum number of traverse points for particulate traverses.

1. *Principle and Applicability*

1.1 Principle. To aid in the representative measurement of pollutant emissions and/or total volumetric flow rate from a stationary source, a measurement site where the effluent stream is flowing in a known direction is selected, and the cross-section of the stack is divided into a number of equal areas. A traverse point is then located within each of these equal areas.

1.2 Applicability. This method is applicable to flowing gas streams in ducts, stacks, and flues. The method cannot be used when: (1) flow is cyclonic or swirling (see Section 2.4), (2) a stack is smaller than about 0.30 meter (12 in.) in diameter, or 0.071 m^2 (113 $in.^2$) in cross-sectional area, or (3) the measurement site is less than two stack or duct diameters downstream or less than a half diameter upstream from a flow disturbance.

The requirements of this method must be considered before construction of a new facility from which emissions will be measured; failure to do so may require subsequent alterations to the stack or deviation from the standard procedure. Cases involving variants are subject to approval by the Administrator, U.S. Environmental Protection Agency.

2. *Procedure*

2.1 Selection of Measurement Site. Sampling or velocity measurement is performed at a site located at least eight stack or duct diameters downstream and two diameters upstream from any flow disturbance such as a bend, expansion, or contraction in the stack, or from a visible flame. If necessary, an alternative location may be selected, at a position at least two stack or duct diameters downstream and a half diameter upstream from any flow disturbance. For a rectangular cross section, an equivalent diameter (D_e) shall be calculated from the following equation, to determine the upstream and downstream distances:

$$D_e = \frac{2LW}{L+W}$$

where L = length and W = width.

2.2 Determining the Number of Traverse Points.

2.2.1 Particulate Traverses. When the eight- and two-diameter criterion can be met, the minimum number of traverse points shall be: (1) twelve, for circular or rectangular stacks with diameters (or equivalent diameters) greater than 0.61 meter (24 in.); (2) eight, for circular stacks with diameters between 0.30 and 0.61 meter (12-24 in.); (3) nine, for rectangular stacks with equivalent diameters between 0.30 and 0.61 meter (12-24 in.).

When the eight- and two-diameter criterion cannot be met, the minimum number of traverse points is determined from Figure 1-1. Before referring to the figure, however, determine the distances from the chosen measurement site to the nearest upstream and downstream disturbances, and divide each distance by the stack diameter or equivalent diameter, to determine the distance in terms of the number of duct diameters. Then, determine from Figure 1-1 the minimum number of traverse points that corresponds: (1) to the number of duct diameters upstream; and (2) to the number of diameters downstream. Select the higher of the two minimum numbers of traverse points, or a greater value, so that for circular stacks the number is a multiple of 4, and for rectangular stacks, the number is one of those shown in Table 1-1.

TABLE 1-1. *Cross-sectional layout for rectangular stacks*

Number of traverse points:	*Metric layout*
9	3x3
12	4x3
16	4x4
20	5x4
25	5x5
30	6x5
36	6x6
42	7x6
49	7x7

2.2.2 Velocity (Non-Particulate) Traverses. When velocity or volumetric flow rate is to be determined (but not particulate matter), the same procedure as that for particulate traverses (Section 2.2.1) is followed, except that Figure 1-2 may be used instead of Figure 1-1.

2.3 Cross-Sectional Layout and Location of Traverse Points.

2.3.1 Circular Stacks. Locate the traverse points on two perpendicular diameters according to Table 1-2 and the example shown in Figure 1-3. Any equation (for examples, see Citations 2 and 3 in the Bibliography) that gives the same values as those in Table 1-2 may be used in lieu of Table 1-2.

For particulate traverses, one of the diameters must be in a plane containing the greatest expected concentration variation, e.g., after bends, one diameter shall be in the plane of the bend. This requirement becomes less critical as the distance from the disturbance increases; therefore, other diameter locations may be used, subject to approval of the Administrator.

In addition, for stacks having diameters greater than 0.61 m (24 in.) no traverse points shall be located within 2.5 centimeters (1.00 in.) of the stack walls; and for stack diameters equal to or less than 0.61 m (24 in.), no traverse points shall be located within 1.3 cm (0.50 in.) of the stack walls. To meet these criteria, observe the procedures given below.

2.3.1.1 Stacks With Diameters Greater Than 0.61 m (24 in.). When any of the traverse points as located in Section 2.3.1 fall within 2.5 cm (1.00 in.) of the stack walls, relocate them away from the stack walls to: (1) a distance of 2.5 cm (1.00 in.); or (2) a distance equal to the nozzle inside diameter, whichever is larger. These relocated traverse points (on each end of a diameter) shall be the "adjusted" traverse points.

Whenever two successive traverse points are combined to form a single adjusted traverse point, treat the adjusted point as two separate traverse points, both in the sampling (or velocity measurement) procedure, and in recording the data.

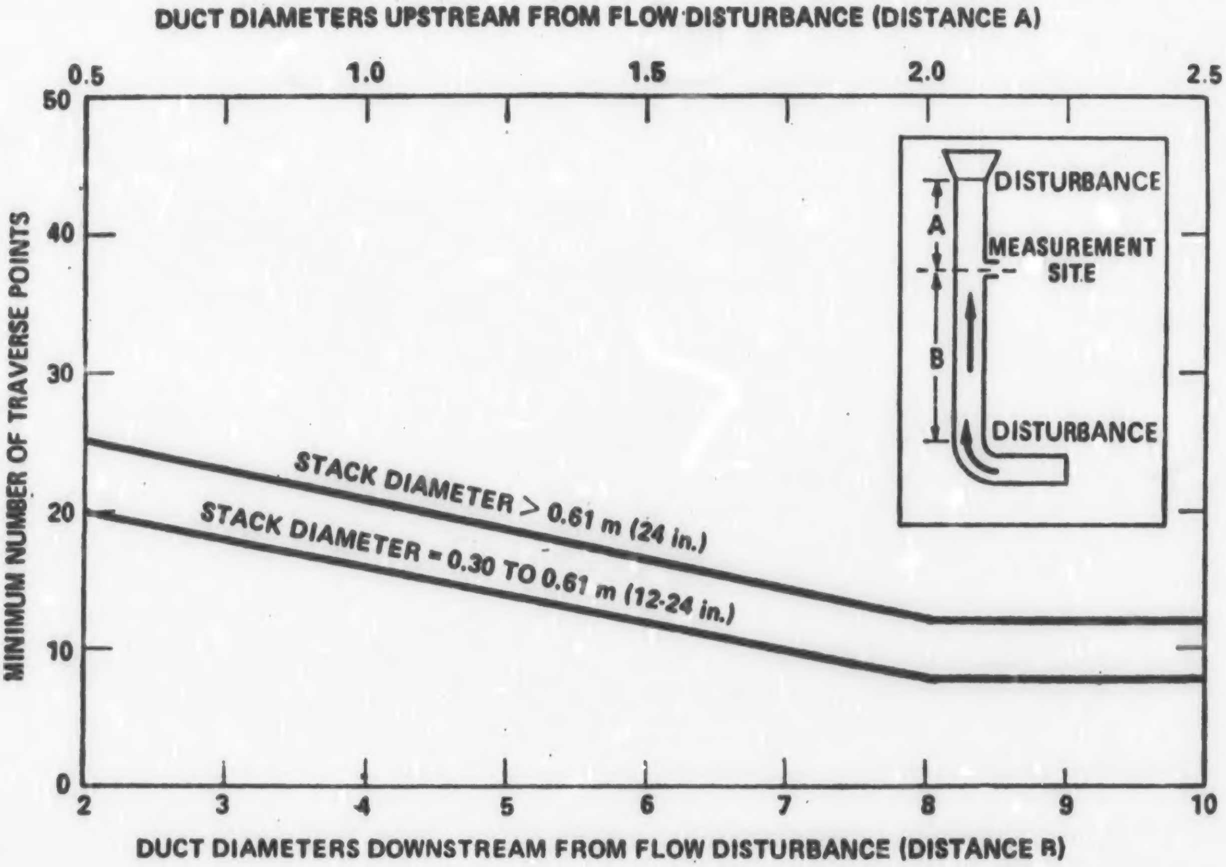

Figure 1-2. Minimum number of traverse points for velocity (nonparticulate) traverses.

TRAVERSE POINT	DISTANCE, % of diameter
1	4.4
2	14.7
3	29.5
4	70.5
5	85.3
6	95.6

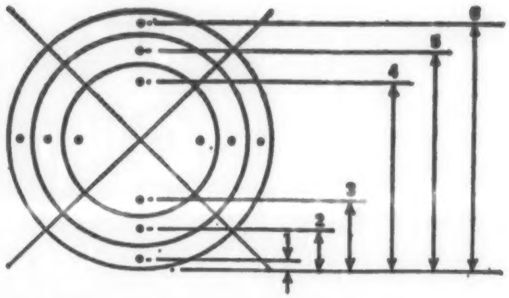

Figure 1-3. Example showing circular stack cross section divided into 12 equal areas, with location of traverse points indicated,

Table 1-2. LOCATION OF TRAVERSE POINTS IN CIRCULAR STACKS
(Percent of stack diameter from inside wall to traverse point)

Traverse point number on a diameter	Number of traverse points on a diameter											
	2	4	6	8	10	12	14	16	18	20	22	24
1	14.6	6.7	4.4	3.2	2.6	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	85.4	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3		75.0	29.6	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4		93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5			85.4	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6			95.6	80.6	65.8	35.6	26.9	22.0	18.8	16.5	14.6	13.2
7				89.5	77.4	64.4	36.6	28.3	23.6	20.4	18.0	16.1
8				96.8	85.4	75.0	63.4	37.5	29.6	25.0	21.8	19.4
9					91.8	82.3	73.1	62.5	38.2	30.6	26.2	23.0
10					97.4	88.2	79.9	71.7	61.8	38.8	31.5	27.2
11						93.3	85.4	78.0	70.4	61.2	39.3	32.3
12						97.9	90.1	83.1	76.4	69.4	60.7	39.8
13							94.3	87.5	81.2	75.0	68.5	60.2
14							98.2	91.5	85.4	79.6	73.8	67.7
15								95.1	89.1	83.5	78.2	72.8
16								98.4	92.5	87.1	82.0	77.0
17									95.6	90.3	85.4	80.6
18									98.6	93.3	88.4	83.9
19										96.1	91.3	86.8
20										98.7	94.0	89.5
21											96.5	92.1
22											98.9	94.5
23												96.8
24												98.9

2.3.1.2 Stacks With Diameters Equal to or Less Than 0.61 m (24 in.). Follow the procedure in Section 2.3.1.1, noting only that any "adjusted" points should be relocated away from the stack walls to: (1) a distance of 1.3 cm (0.50 in.); or (2) a distance equal to the nozzle inside diameter, whichever is larger.

2.3.2 Rectangular Stacks. Determine the number of traverse points as explained in Sections 2.1 and 2.2 of this method. From Table 1-1, determine the grid configuration. Divide the stack cross-section into as many equal rectangular elemental areas as traverse points, and then locate a traverse point at the centroid of each equal area according to the example in Figure 1-4.

The situation of traverse points being too close to the stack walls is not expected to arise with rectangular stacks. If this problem should ever arise, the Administrator must be contacted for resolution of the matter.

2.4 Verification of Absence of Cyclonic Flow. In most stationary sources, the direction of stack gas flow is essentially parallel to the stack walls. However, cyclonic flow may exist (1) after such devices as cyclones and inertial demisters following venturi scrubbers, or (2) in stacks having tangential inlets or other duct configurations which tend to induce swirling; in these instances, the presence or absence of cyclonic flow at the sampling location must be determined. The following techniques are acceptable for this determination.

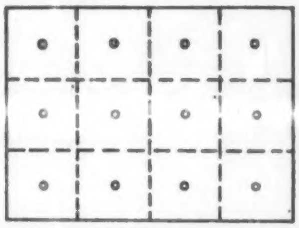

Figure 1-4. Example showing rectangular stack cross section divided into 12 equal areas, with a traverse point at centroid of each area.

Level and zero the manometer. Connect a Type S pitot tube to the manometer. Position the Type S pitot tube at each traverse point, in succession, so that the planes of the face openings of the pitot tube are perpendicular to the stack cross-sectional plane: when the Type S pitot tube is in this position, it is at "0° reference." Note the differential pressure (Δp) reading at each traverse point. If a null (zero) pitot reading is obtained at 0° reference at a given traverse point, an acceptable flow condition exists at that point. If the pitot reading is not zero at 0° reference, rotate the pitot tube (up to ±90° yaw angle), until a null reading is obtained. Carefully determine and record the value of the rotation angle (α) to the nearest degree. After the null technique has been applied at each travrse point, calculate the average of the absolute values of α; assign α values of 0° to those points for which no rotation was required, and include these in the overall average. If the average value of α is greater than 10°, the overall flow condition in the stack is unacceptable and alternative methodology, subject to the approval of the Administrator, must be used to perform accurate sample and velocity traverses.

3. *Bibliography*

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METHOD 2—DETERMINATION OF STACK GAS VELOCITY AND VOLUMETRIC FLOW RATE (TYPE S PITOT TUBE) 69

1. *Principle and Applicability*

1.1 Principle. The average gas velocity in a stack is determined from the gas density and from measurement of the average velocity head with a Type S (Stausscheibe or reverse type) pitot tube.

1.2 Applicability. This method is applicable for measurement of the average velocity of a gas stream and for quantifying gas flow.

This procedure is not applicable at measurement sites which fail to meet the criteria of Method 1, Section 2.1. Also, the method cannot be used for direct measurement in cyclonic or swirling gas streams; Section 2.4 of Method 1 shows how to determine cyclonic or swirling flow conditions. When unacceptable conditions exist, alternative procedures, subject to the approval of the Administrator, U.S. Environmental Protection Agency, must be employed to make accurate flow rate determinations; examples of such alternative procedures are: (1) to install straightening vanes; (2) to calculate the total volumetric flow rate stoichiometrically, or (3) to move to another measurement site at which the flow is acceptable.

2. *Apparatus*

Specifications for the apparatus are given below. Any other apparatus that has been demonstrated (subject to approval of the Administrator) to be capable of meeting the specifications will be considered acceptable.

2.1 Type S Pitot Tube. The Type S pitot tube (Figure 2-1) shall be made of metal tubing (e.g., stainless steel). It is recommended that the external tubing diameter (dimension D_t, Figure 2-2b) be between 0.48 and 0.95 centimeters ($\frac{3}{16}$ and $\frac{3}{8}$ inch). There shall be an equal distance from the base of each leg of the pitot tube to its face-opening plane (dimensions P_A and P_B, Figure 2-2b); it is recommended that this distance be between 1.05 and 1.50 times the external tubing diameter. The face openings of the pitot tube shall, preferably, be aligned as shown in Figure 2-2; however, slight misalignments of the openings are permissible (see Figure 2-3).

The Type S pitot tube shall have a known coefficient, determined as outlined in Section 4. An identification number shall be assigned to the pitot tube; this number shall be permanently marked or engraved on the body of the tube.

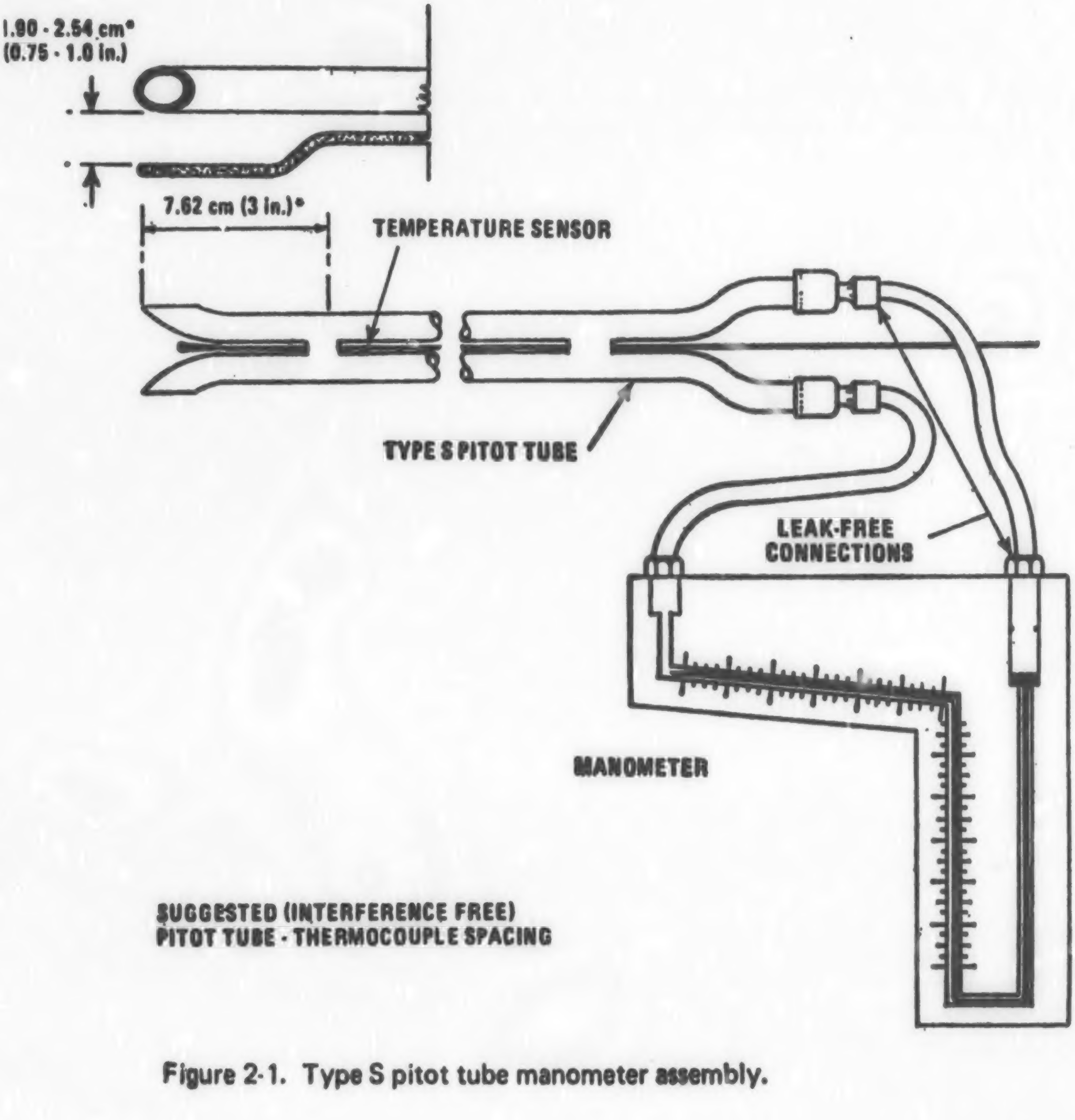


Figure 2-1. Type S pitot tube manometer assembly.

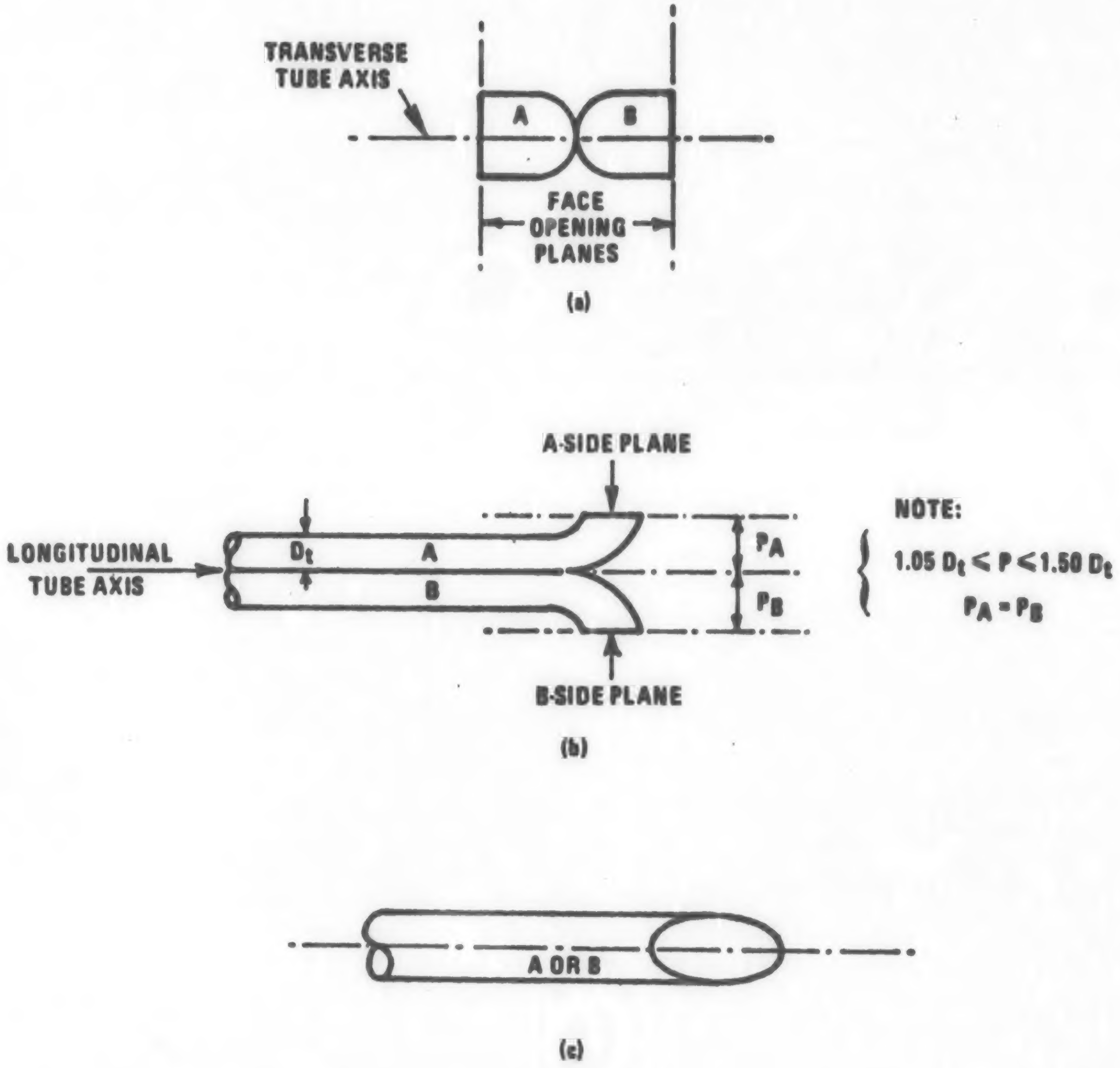

TRANSVERSE TUBE AXIS
A
B
FACE OPENING PLANES
(a)
A-SIDE PLANE
LONGITUDINAL TUBE AXIS
D_t
A
B
P_A
P_B
B-SIDE PLANE
NOTE:
$1.05\ D_t < P < 1.50\ D_t$
$P_A = P_B$
(b)
A OR B
(c)

Figure 2-2. Properly constructed Type S pitot tube, shown in: (a) end view; face opening planes perpendicular to transverse axis; (b) top view; face opening planes parallel to longitudinal axis; (c) side view; both legs of equal length and centerlines coincident, when viewed from both sides. Baseline coefficient values of 0.84 may be assigned to pitot tubes constructed this way.

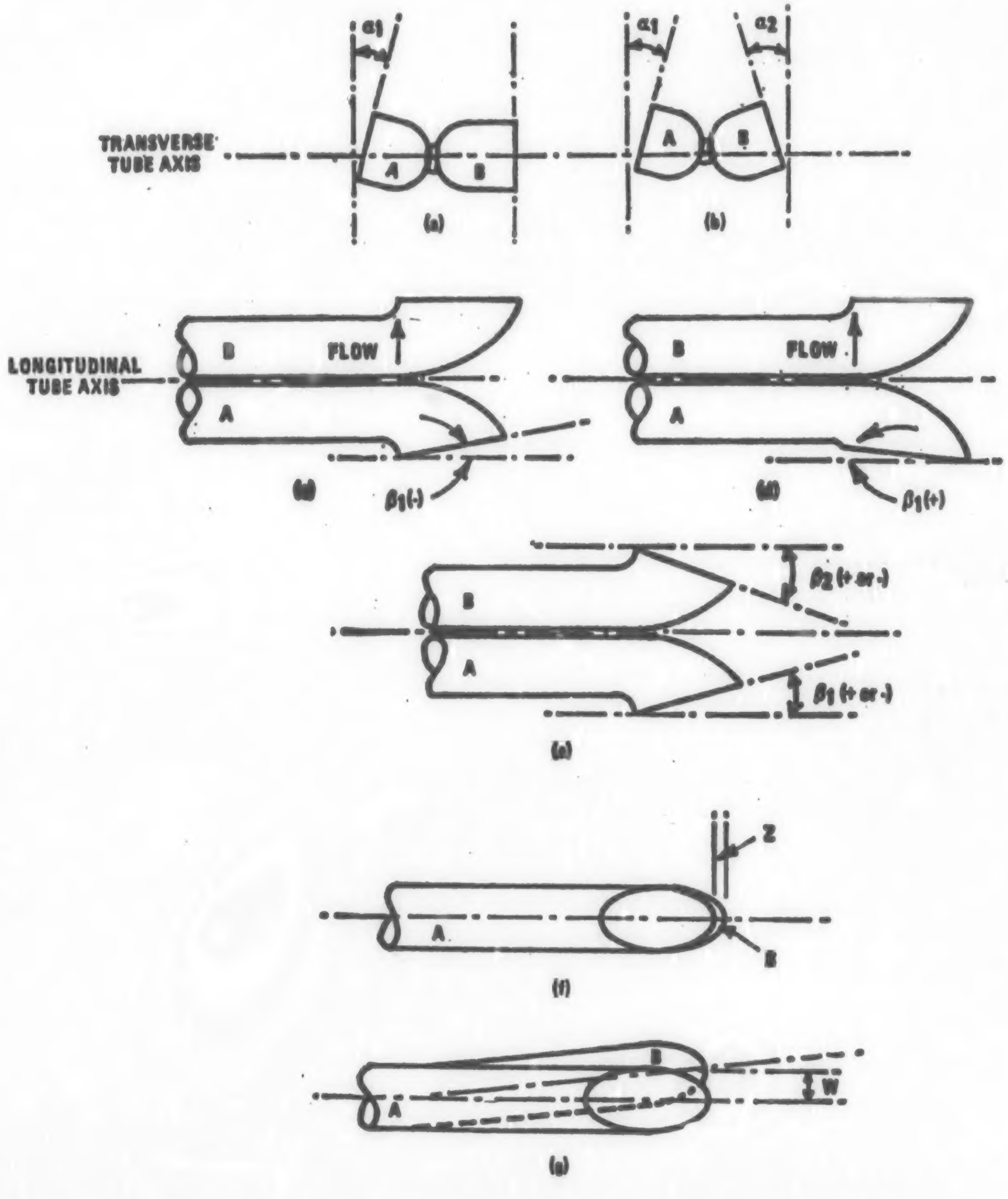

α1
α2
TRANSVERSE TUBE AXIS
A
B
(a)
(b)
LONGITUDINAL TUBE AXIS
FLOW
(c)
(d)
β1(-)
β1(+)
β2 (+ or -)
β1 (+ or -)
(e)
Z
(f)
W
(g)

Figure 2-3. Types of face-opening misalignment that can result from field use or improper construction of Type S pitot tubes. These will not affect the baseline value of $\bar{C}_{p(s)}$ so long as α_1 and $\alpha_2 < 10^\circ$, β_1 and $\beta_2 < 5^\circ$, $z < 0.32$ cm (1/8 in.) and $w < 0.08$ cm (1/32 in.) (citation 11 in Section 6).

A standard pitot tube may be used instead of a Type S, provided that it meets the specifications of Sections 2.7 and 4.2; note, however, that the static and impact pressure holes of standard pitot tubes are susceptible to plugging in particulate-laden gas streams. Therefore, whenever a standard pitot tube is used to perform a traverse, adequate proof must be furnished that the openings of the pitot tube have not plugged up during the traverse period; this can be done by taking a velocity head (Δp) reading at the final traverse point, cleaning out the impact and static holes of the standard pitot tube by "back-purging" with pressurized air, and then taking another Δp reading. If the Δp readings made before and after the air purge are the same (±5 percent), the traverse is acceptable. Otherwise, reject the run. Note that if Δp at the final traverse point is unsuitably low, another point may be selected. If "back-purging" at regular intervals is part of the procedure, then comparative Δp readings shall be taken, as above, for the last two back purges at which suitably high Δp readings are observed.

2.2 Differential Pressure Gauge. An inclined manometer or equivalent device is used. Most sampling trains are equipped with a 10-in. (water column) inclined-vertical manometer, having 0.01-in. H_2O divisions on the 0- to 1-in. inclined scale, and 0.1-in. H_2O divisions on the 1- to 10-in. vertical scale. This type of manometer (or other gauge of equivalent sensitivity) is satisfactory for the measurement of Δp values as low as 1.3 mm (0.05 in.) H_2O. However, a differential pressure gauge of greater sensitivity shall be used (subject to the approval of the Administrator), if any of the following is found to be true: (1) the arithmetic average of all Δp readings at the traverse points in the stack is less than 1.3 mm (0.05 in.) H_2O; (2) for traverses of 12 or more points, more than 10 percent of the individual Δp readings are below 1.3 mm (0.05 in.) H_2O; (3) for traverses of fewer than 12 points, more than one Δp reading is below 1.3 mm (0.05 in.) H_2O. Citation 18 in Section 6 describes commercially available instrumentation for the measurement of low-range gas velocities.

As an alternative to criteria (1) through (3) above, the following calculation may be performed to determine the necessity of using a more sensitive differential pressure gauge:

$$T=\frac{\sum_{i=1}^{n}\sqrt{\Delta p_i+K}}{\sum_{i=1}^{n}\sqrt{\Delta p_i}}$$

where:

Δp_i = Individual velocity head reading at a traverse point, mm H_2O (in. H_2O).

n = Total number of traverse points.

K = 0.13 mm H_2O when metric units are used and 0.005 in H_2O when English units are used.

If T is greater than 1.05, the velocity head data are unacceptable and a more sensitive differential pressure gauge must be used.

NOTE.—If differential pressure gauges other than inclined manometers are used (e.g., magnehelic gauges), their calibration must be checked after each test series. To check the calibration of a differential pressure gauge, compare Δp readings of the gauge with those of a gauge-oil manometer at a minimum of three points, approximately representing the range of Δp values in the stack. If, at each point, the values of Δp as read by the differential pressure gauge and gauge-oil manometer agree to within 5 percent, the differential pressure gauge shall be considered to be in proper calibration. Otherwise, the test series shall either be voided, or procedures to adjust the measured Δp values and final results shall be used, subject to the approval of the Administrator.

2.3 Temperature Gauge. A thermocouple, liquid-filled bulb thermometer, bimetallic thermometer, mercury-in-glass thermometer, or other gauge capable of measuring temperature to within 1.5 percent of the minimum absolute stack temperature shall be used. The temperature gauge shall be attached to the pitot tube such that the sensor tip does not touch any metal; the gauge shall be in an interference-free arrangement with respect to the pitot tube face openings (see Figure 2-1 and also Figure 2-7 in Section 4). Alternate positions may be used if the pitot tube-temperature gauge system is calibrated according to the procedure of Section 4. Provided that a difference of not more than 1 percent in the average velocity measurement is introduced, the temperature gauge need not be attached to the pitot tube; this alternative is subject to the approval of the Administrator.

2.4 Pressure Probe and Gauge. A piezometer tube and mercury- or water-filled U-tube manometer capable of measuring stack pressure to within 2.5 mm (0.1 in.) Hg is used. The static tap of a standard type pitot tube or one leg of a Type S pitot tube with the face opening planes positioned parallel to the gas flow may also be used as the pressure probe.

2.5 Barometer. A mercury, aneroid, or other barometer capable of measuring atmospheric pressure to within 2.5 mm Hg (0.1 in. Hg) may be used. In many cases, the barometric reading may be obtained from a nearby national weather service station, in which case the station value (which is the absolute barometric pressure) shall be requested and an adjustment for elevation differences between the weather station and the sampling point shall be applied at a rate of minus 2.5 mm (0.1 in.) Hg per 30-meter (100 foot) elevation increase, or vice-versa for elevation decrease.

2.6 Gas Density Determination Equipment. Method 3 equipment, if needed (see Section 3.6), to determine the stack gas dry molecular weight, and Reference Method 4 or Method 5 equipment for moisture content determination; other methods may be used subject to approval of the Administrator.

2.7 Calibration Pitot Tube. When calibration of the Type S pitot tube is necessary (see Section 4), a standard pitot tube is used as a reference. The standard pitot tube shall, preferably, have a known coefficient, obtained either (1) directly from the National Bureau of Standards, Route 270, Quince Orchard Road, Gaithersburg, Maryland, or (2) by calibration against another standard pitot tube with an NBS-traceable coefficient. Alternatively, a standard pitot tube designed according to the criteria given in 2.7.1 through 2.7.5 below and illustrated in Figure 2-4 (see also Citations 7, 8, and 17 in Section 6) may be used. Pitot tubes designed according to these specifications will have baseline coefficients of about 0.99±0.01.

2.7.1 Hemispherical (shown in Figure 2-4), ellipsoidal, or conical tip.

2.7.2 A minimum of six diameters straight run (based upon D, the external diameter of the tube) between the tip and the static pressure holes.

2.7.3 A minimum of eight diameters straight run between the static pressure holes and the centerline of the external tube, following the 90 degree bend.

2.7.4 Static pressure holes of equal size (approximately 0.1 D), equally spaced in a piezometer ring configuration.

2.7.5 Ninety degree bend, with curved or mitered junction.

2.8 Differential Pressure Gauge for Type S Pitot Tube Calibration. An inclined manometer or equivalent is used. If the single-velocity calibration technique is employed (see Section 4.1.2.3), the calibration differential pressure gauge shall be readable to the nearest 0.13 mm H_2O (0.005 in. H_2O). For multivelocity calibrations, the gauge shall be readable to the nearest 0.13 mm H_2O (0.005 in H_2O) for Δp values between 1.3 and 25 mm H_2O (0.05 and 1.0 in. H_2O), and to the nearest 1.3 mm H_2O (0.05 in. H_2O) for Δp values above 25 mm H_2O (1.0 in. H_2O). A special, more sensitive gauge will be required to read Δp values below 1.3 mm H_2O [0.05 in. H_2O] (see Citation 18 in Section 6).

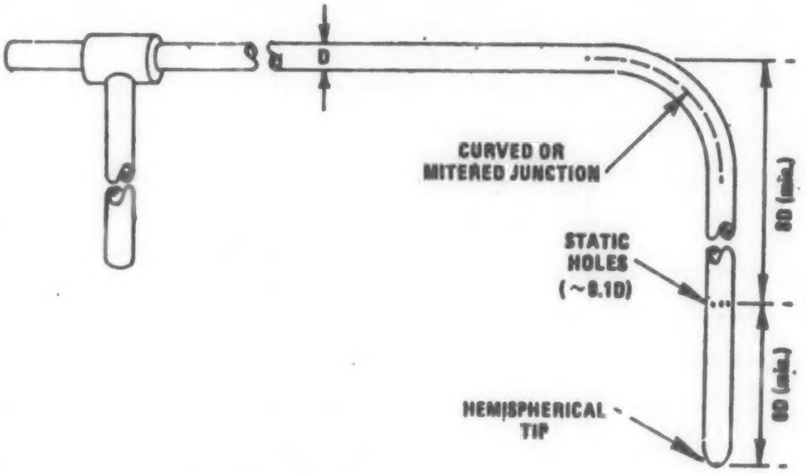


Figure 2-4. Standard pitot tube design specifications.

3. *Procedure*

3.1 Set up the apparatus as shown in Figure 2-1. Capillary tubing or surge tanks installed between the manometer and pitot tube may be used to dampen Δp fluctuations. It is recommended, but not required, that a pretest leak-check be conducted, as follows: (1) blow through the pitot impact opening until at least 7.6 cm (3 in.) H_2O velocity pressure registers on the manometer; then, close off the impact opening. The pressure shall remain stable for at least 15 seconds; (2) do the same for the static pressure side, except using suction to obtain the minimum of 7.6 cm (3 in.) H_2O. Other leak-check procedures, subject to the approval of the Administrator, may be used.

3.2 Level and zero the manometer. Because the manometer level and zero may drift due to vibrations and temperature changes, make periodic checks during the traverse. Record all necessary data as shown in the example data sheet (Figure 2-5).

3.3 Measure the velocity head and temperature at the traverse points specified by Method 1. Ensure that the proper differential pressure gauge is being used for the range of Δp values encountered (see Section 2.2). If it is necessary to change to a more sensitive gauge, do so, and remeasure the Δp and temperature readings at each traverse point. Conduct a post-test leak-check (mandatory), as described in Section 3.1 above, to validate the traverse run.

3.4 Measure the static pressure in the stack. One reading is usually adequate.

3.5 Determine the atmospheric pressure.

PLANT ______________________________

DATE ______________ RUN NO. ______________

STACK DIAMETER OR DIMENSIONS, m(in.) ______________

BAROMETRIC PRESSURE, mm Hg (in. Hg) ______________

CROSS SECTIONAL AREA, m^2(ft^2) ______________

OPERATORS ______________

PITOT TUBE I.D. NO. ______________

AVG. COEFFICIENT, C_p = ______________

LAST DATE CALIBRATED ______________

SCHEMATIC OF STACK CROSS SECTION

Traverse Pt. No.	Vel. Hd., Δp mm (in.) H_2O	Stack Temperature		P_g mm Hg (in.Hg)	$\sqrt{\Delta p}$
		t_s, °C (°F)	T_s, °K (°R)		
		Average			

Figure 2-5. Velocity traverse data.

3.6 Determine the stack gas dry molecular weight. For combustion processes or processes that emit essentially CO_2, O_2, CO, and N_2, use Method 3. For processes emitting essentially air, an analysis need not be conducted; use a dry molecular weight of 29.0. For other processes, other methods, subject to the approval of the Administrator, must be used.

3.7 Obtain the moisture content from Reference Method 4 (or equivalent) or from Method 5.

3.8 Determine the cross-sectional area of the stack or duct at the sampling location. Whenever possible, physically measure the stack dimensions rather than using blueprints.

4. *Calibration*

4.1 Type S Pitot Tube. Before its initial use, carefully examine the Type S pitot tube in top, side, and end views to verify that the face openings of the tube are aligned within the specifications illustrated in Figure 2-2 or 2-3. The pitot tube shall not be used if it fails to meet these alignment specifications.

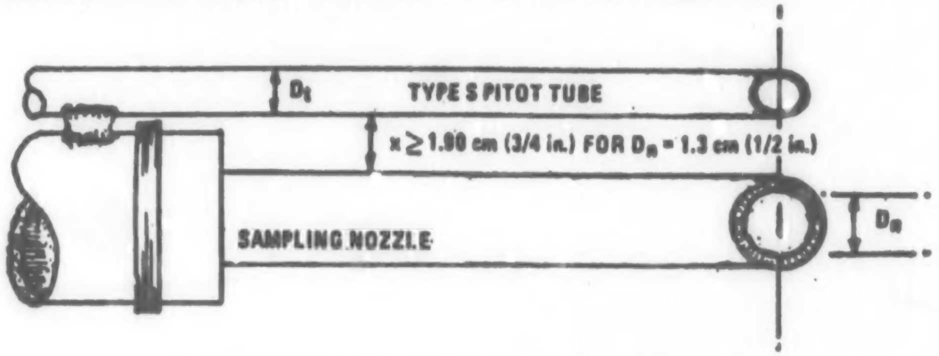
After verifying the face opening alignment, measure and record the following dimensions of the pitot tube: (a) the external tubing diameter (dimension D_t, Figure 2-2b); and (b) the base-to-opening plane distances (dimensions P_A and P_B, Figure 2-2b). If D_t is between 0.48 and 0.95 cm (3/16 and 3/8 in.) and if P_A and P_B are equal and between 1.05 and 1.50 D_t, there are two possible options: (1) the pitot tube may be calibrated according to the procedure outlined in Sections 4.1.2 through 4.1.5 below, or (2) a baseline (isolated tube) coefficient value of 0.84 may be assigned to the pitot tube. Note, however, that if the pitot tube is part of an assembly, calibration may still be required, despite knowledge of the baseline coefficient value (see Section 4.1.1).

If D_t, P_A, and P_B are outside the specified limits, the pitot tube must be calibrated as outlined in 4.1.2 through 4.1.5 below.

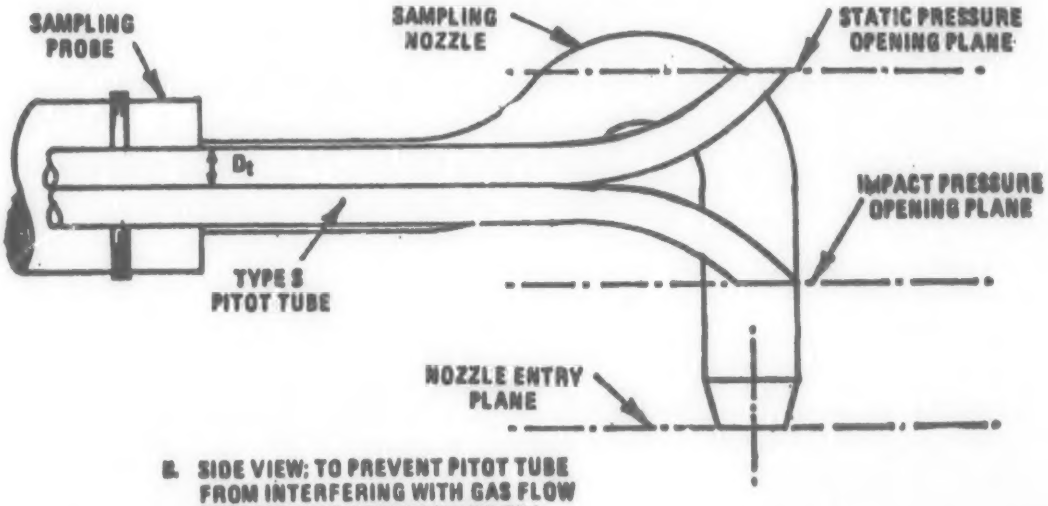
4.1.1 Type S Pitot Tube Assemblies. During sample and velocity traverses, the isolated Type S pitot tube is not always used; in many instances, the pitot tube is used in combination with other source-sampling components (thermocouple, sampling probe, nozzle) as part of an "assembly." The presence of other sampling components can sometimes affect the baseline value of the Type S pitot tube coefficient (Citation 9 in Section 6); therefore an assigned (or otherwise known) baseline coefficient value may or may not be valid for a given assembly. The baseline and assembly coefficient values will be identical only when the relative placement of the components in the assembly is such that aerodynamic interference effects are eliminated. Figures 2-6 through 2-8 illustrate interference-free component arrangements for Type S pitot tubes having external tubing diameters between 0.48 and 0.95 cm (3/16 and 3/8 in.). Type S pitot tube assemblies that fail to meet any or all of the specifications of Figures 2-6 through 2-8 shall be calibrated according to the procedure outlined in Sections 4.1.2 through 4.1.5 below, and prior to calibration, the values of the intercomponent spacings (pitot-nozzle, pitot-thermocouple, pitot-probe sheath) shall be measured and recorded.

NOTE.—Do not use any Type S pitot tube assembly which is constructed such that the impact pressure opening plane of the pitot tube is below the entry plane of the nozzle (see Figure 2-6b).

4.1.2 Calibration Setup. If the Type S pitot tube is to be calibrated, one leg of the tube shall be permanently marked A, and the other, B. Calibration shall be done in a flow system having the following essential design features:



A. BOTTOM VIEW; SHOWING MINIMUM PITOT-NOZZLE SEPARATION.



B. SIDE VIEW; TO PREVENT PITOT TUBE FROM INTERFERING WITH GAS FLOW STREAMLINES APPROACHING THE NOZZLE, THE IMPACT PRESSURE OPENING PLANE OF THE PITOT TUBE SHALL BE EVEN WITH OR ABOVE THE NOZZLE ENTRY PLANE.

Figure 2-6. Proper pitot tube - sampling nozzle configuration to prevent aerodynamic interference; buttonhook - type nozzle; centers of nozzle and pitot opening aligned; D_t between 0.48 and 0.95 cm (3/16 and 3/8 in.).

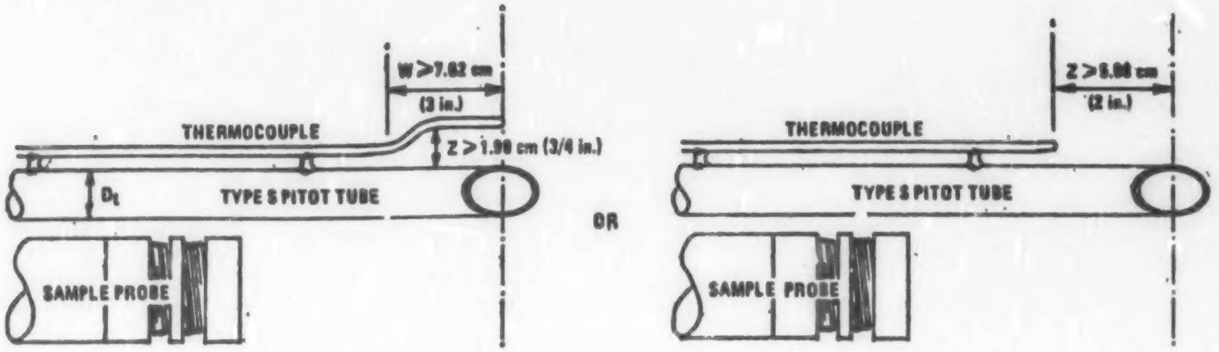


Figure 2-7. Proper thermocouple placement to prevent interference; D_t between 0.48 and 0.95 cm (3/16 and 3/8 in.).

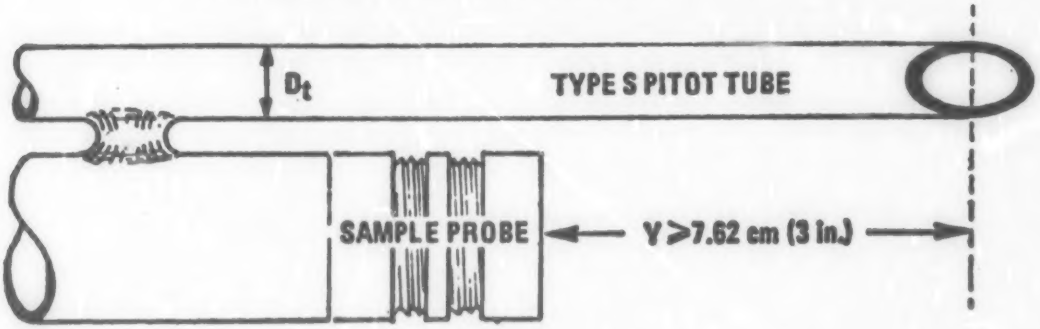


Figure 2-8. Minimum pitot-sample probe separation needed to prevent interference; D_t between 0.48 and 0.95 cm (3/16 and 3/8 in.).

4.1.2.1 The flowing gas stream must be confined to a duct of definite cross-sectional area, either circular or rectangular. For circular cross-sections, the minimum duct diameter shall be 30.5 cm (12 in.); for rectangular cross-sections, the width (shorter side) shall be at least 25.4 cm (10 in.).

4.1.2.2 The cross-sectional area of the calibration duct must be constant over a distance of 10 or more duct diameters. For a rectangular cross-section, use an equivalent diameter, calculated from the following equation, to determine the number of duct diameters:

$$D_e = \frac{2LW}{(L+W)}$$

Equation 2-1

where:

D_e = Equivalent diameter
L = Length
W = Width

To ensure the presence of stable, fully developed flow patterns at the calibration site, or "test section," the site must be located at least eight diameters downstream and two diameters upstream from the nearest disturbances.

NOTE.—The eight- and two-diameter criteria are not absolute; other test section locations may be used (subject to approval of the Administrator), provided that the flow at the test site is stable and demonstrably parallel to the duct axis.

4.1.2.3 The flow system shall have the capacity to generate a test-section velocity around 915 m/min (3,000 ft/min). This velocity must be constant with time to guarantee steady flow during calibration. Note that Type S pitot tube coefficients obtained by single-velocity calibration at 915 m/min (3,000 ft/min) will generally be valid to within ±3 percent for the measurement of velocities above 305 m/min (1,000 ft/min) and to within ±5 to 6 percent for the measurement of velocities between 180 and 305 m/min (600 and 1,000 ft/min). If a more precise correlation between C_p and velocity is desired, the flow system shall have the capacity to generate at least four distinct, time-invariant test-section velocities covering the velocity range from 180 to 1,525 m/min (600 to 5,000 ft/min), and calibration data shall be taken at regular velocity intervals over this range (see Citations 9 and 14 in Section 6 for details).

4.1.2.4 Two entry ports, one each for the standard and Type S pitot tubes, shall be cut in the test section; the standard pitot entry port shall be located slightly downstream of the Type S port, so that the standard and Type S impact openings will lie in the same cross-sectional plane during calibration. To facilitate alignment of the pitot tubes during calibration, it is advisable that the test section be constructed of plexiglas or some other transparent material.

4.1.3 Calibration Procedure. Note that this procedure is a general one and must not be used without first referring to the special considerations presented in Section 4.1.5. Note also that this procedure applies only to single-velocity calibration. To obtain calibration data for the A and B sides of the Type S pitot tube, proceed as follows:

4.1.3.1 Make sure that the manometer is properly filled and that the oil is free from contamination and is of the proper density. Inspect and leak-check all pitot lines; repair or replace if necessary.

4.1.3.2 Level and zero the manometer. Turn on the fan and allow the flow to stabilize. Seal the Type S entry port.

4.1.3.3 Ensure that the manometer is level and zeroed. Position the standard pitot tube at the calibration point (determined as outlined in Section 4.1.5.1), and align the tube so that its tip is pointed directly into the flow. Particular care should be taken in aligning the tube to avoid yaw and pitch angles. Make sure that the entry port surrounding the tube is properly sealed.

4.1.3.4 Read Δp_{std} and record its value in a data table similar to the one shown in Figure 2-9. Remove the standard pitot tube from the duct and disconnect it from the manometer. Seal the standard entry port.

4.1.3.5 Connect the Type S pitot tube to the manometer. Open the Type S entry port. Check the manometer level and zero. Insert and align the Type S pitot tube so that its A side impact opening is at the same point as was the standard pitot tube and is pointed directly into the flow. Make sure that the entry port surrounding the tube is properly sealed.

4.1.3.6 Read Δp_s and enter its value in the data table. Remove the Type S pitot tube from the duct and disconnect it from the manometer.

4.1.3.7 Repeat steps 4.1.3.3 through 4.1.3.6 above until three pairs of Δp readings have been obtained.

4.1.3.8 Repeat steps 4.1.3.3 through 4.1.3.7 above for the B side of the Type S pitot tube.

4.1.3.9 Perform calculations, as described in Section 4.1.4 below.

4.1.4 Calculations.

4.1.4.1 For each of the six pairs of Δp readings (i.e., three from side A and three from side B) obtained in Section 4.1.3 above, calculate the value of the Type S pitot tube coefficient as follows:

PITOT TUBE IDENTIFICATION NUMBER: ____________ DATE: ____________

CALIBRATED BY: ________________________

	"A" SIDE CALIBRATION			
RUN NO.	Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(A)$
1				
2				
3				
		$\bar{C}_p$ (SIDE A)		

	"B" SIDE CALIBRATION			
RUN NO.	Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(B)$
1				
2				
3				
		$\bar{C}_p$ (SIDE B)		

$$\text{AVERAGE DEVIATION} = \sigma\text{ (A OR B)} = \frac{\sum_{1}^{3} \left| C_p(s) - \bar{C}_p(\text{A OR B}) \right|}{3} \longleftarrow \text{MUST BE} < 0.01$$

$$\left| \bar{C}_p\text{ (SIDE A)} - \bar{C}_p\text{ (SIDE B)} \right| \longleftarrow \text{MUST BE} < 0.01$$

Figure 2-9. Pitot tube calibration data.

$$C_{p(s)} = C_{p(std)} \sqrt{\frac{\Delta p_{std}}{\Delta p_s}}$$

Equation 2-2

where:

$C_{p(s)}$ = Type S pitot tube coefficient

$C_{p(std)}$ = Standard pitot tube coefficient; use 0.99 if the coefficient is unknown and the tube is designed according to the criteria of Sections 2.7.1 to 2.7.5 of this method.

Δp_{std} = Velocity head measured by the standard pitot tube, cm H_2O (in. H_2O)

Δp_s = Velocity head measured by the Type S pitot tube, cm H_2O (in. H_2O)

4.1.4.2 Calculate $\bar{C}_p$ (side A), the mean A-side coefficient, and $\bar{C}_p$ (side B), the mean B-side coefficient; calculate the difference between these two average values.

4.1.4.3 Calculate the deviation of each of the three A-side values of $C_{p(s)}$ from $\bar{C}_p$ (side A), and the deviation of each B-side value of $C_{p(s)}$ from $\bar{C}_p$ (side B). Use the following equation:

$$\text{Deviation} = C_{p(s)} - \bar{C}_p(\text{A or B})$$

Equation 2-3

4.1.4.4 Calculate σ, the average deviation from the mean, for both the A and B sides of the pitot tube. Use the following equation:

$$\sigma\text{ (side A or B)} = \frac{\sum_{1}^{3} \left| C_{p(s)} - \bar{C}_p(A \text{ or } B) \right|}{3}$$

Equation 2-4

4.1.4.5 Use the Type S pitot tube only if the values of σ (side A) and σ (side B) are less than or equal to 0.01 and if the absolute value of the difference between $\bar{C}_p$ (A) and $\bar{C}_p$ (B) is 0.01 or less.

4.1.5 Special considerations.

4.1.5.1 Selection of calibration point.

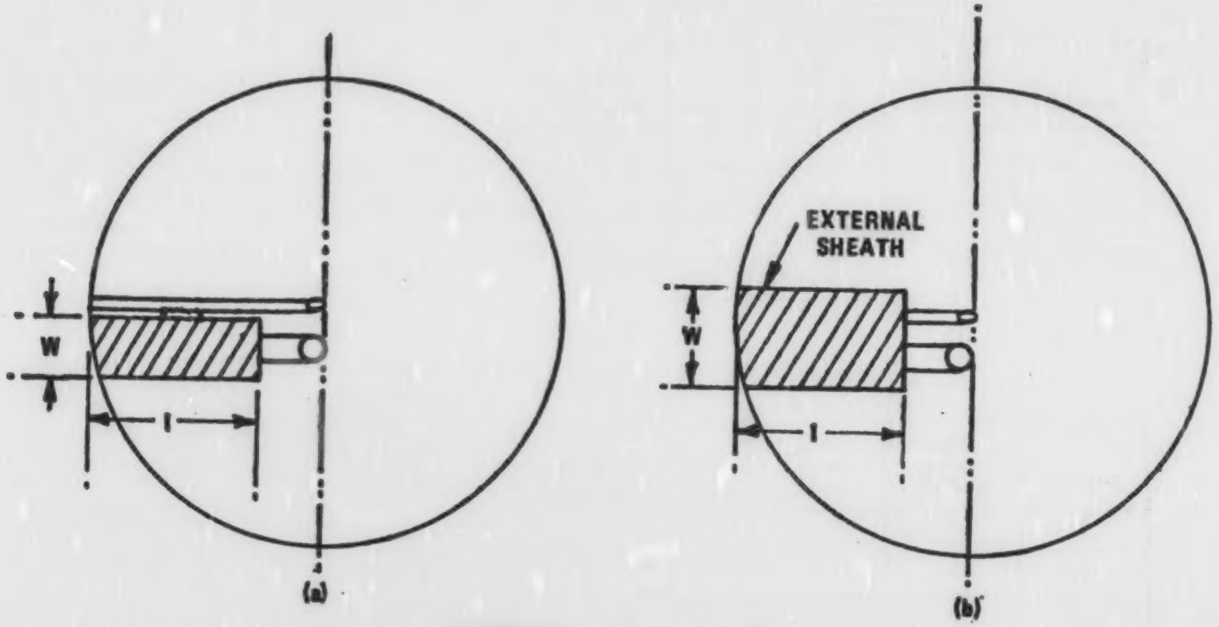
4.1.5.1.1 When an isolated Type S pitot tube is calibrated, select a calibration point at or near the center of the duct, and follow the procedures outlined in Sections 4.1.3 and 4.1.4 above. The Type S pitot coefficients so obtained, i.e., $\bar{C}_p$ (side A) and $\bar{C}_p$ (side B), will be valid, so long as either: (1) the isolated pitot tube is used; or (2) the pitot tube is used with other components (nozzle, thermocouple, sample probe) in an arrangement that is free from aerodynamic interference effects (see Figures 2-6 through 2-8).

4.1.5.1.2 For Type S pitot tube-thermocouple combinations (without sample probe), select a calibration point at or near the center of the duct, and follow the procedures outlined in Sections 4.1.3 and 4.1.4 above. The coefficients so obtained will be valid so long as the pitot tube-thermocouple combination is used by itself or with other components in an interference-free arrangement (Figures 2-6 and 2-8).

4.1.5.1.3 For assemblies with sample probes, the calibration point should be located at or near the center of the duct; however, insertion of a probe sheath into a small duct may cause significant cross-sectional area blockage and yield incorrect coefficient values (Citation 9 in Section 6). Therefore, to minimize the blockage effect, the calibration point may be a few inches off-center if necessary. The actual blockage effect will be negligible when the theoretical blockage, as determined by a projected-area model of the probe sheath, is 2 percent or less of the duct cross-sectional area for assemblies without external sheaths (Figure 2-10a), and 3 percent or less for assemblies with external sheaths (Figure 2-10b).

4.1.5.2 For those probe assemblies in which pitot tube-nozzle interference is a factor (i.e., those in which the pitot-nozzle separation distance fails to meet the specification illustrated in Figure 2-6a), the value of $C_{p(s)}$ depends upon the amount of free-space between the tube and nozzle, and therefore is a function of nozzle size. In these instances, separate calibrations shall be performed with each of the commonly used nozzle sizes in place. Note that the single-velocity calibration technique is acceptable for this purpose, even though the larger nozzle sizes (>0.635 cm or ¼ in.) are not ordinarily used for isokinetic sampling at velocities around 915 m/min (3,000 ft/min), which is the calibration velocity; note also that it is not necessary to draw an isokinetic sample during calibration (see Citation 19 in Section 6).

4.1.5.3 For a probe assembly constructed such that its pitot tube is always used in the same orientation, only one side of the pitot tube need be calibrated (the side which will face the flow). The pitot tube must still meet the alignment specifications of Figure 2-2 or 2-3, however, and must have an average deviation (σ) value of 0.01 or less (see Section 4.1.4.4).



$$\text{ESTIMATED SHEATH BLOCKAGE (\%)} = \left[\frac{l \times W}{\text{DUCT AREA}}\right] \times 100$$

Figure 2-10. Projected-area models for typical pitot tube assemblies.

4.1.6 **Field Use and Recalibration.**

4.1.6.1 **Field Use.**

4.1.6.1.1 When a Type S pitot tube (isolated tube or assembly) is used in the field, the appropriate coefficient value (whether assigned or obtained by calibration) shall be used to perform velocity calculations. For calibrated Type S pitot tubes, the A side coefficient shall be used when the A side of the tube faces the flow, and the B side coefficient shall be used when the B side faces the flow; alternatively, the arithmetic average of the A and B side coefficient values may be used, irrespective of which side faces the flow.

4.1.6.1.2 When a probe assembly is used to sample a small duct (12 to 36 in. in diameter), the probe sheath sometimes blocks a significant part of the duct cross-section, causing a reduction in the effective value of $\bar{C}_{p(s)}$. Consult Citation 9 in Section 6 for details. Conventional pitot-sampling probe assemblies are not recommended for use in ducts having inside diameters smaller than 12 inches (Citation 10 in Section 6).

4.1.6.2 **Recalibration.**

4.1.6.2.1 Isolated Pitot Tubes. After each field use, the pitot tube shall be carefully reexamined in top, side, and end views. If the pitot face openings are still aligned within the specifications illustrated in Figure 2-2 or 2-3, it can be assumed that the baseline coefficient of the pitot tube has not changed. If, however, the tube has been damaged to the extent that it no longer meets the specifications of Figure 2-2 or 2-3, the damage shall either be repaired to restore proper alignment of the face openings or the tube shall be discarded.

4.1.6.2.2 Pitot Tube Assemblies. After each field use, check the face opening alignment of the pitot tube, as in Section 4.1.6.2.1; also, remeasure the intercomponent spacings of the assembly. If the intercomponent spacings have not changed and the face opening alignment is acceptable, it can be assumed that the coefficient of the assembly has not changed. If the face opening alignment is no longer within the specifications of Figures 2-2 or 2-3, either repair the damage or replace the pitot tube (calibrating the new assembly, if necessary). If the intercomponent spacings have changed, restore the original spacings or recalibrate the assembly.

4.2 Standard pitot tube (if applicable). If a standard pitot tube is used for the velocity traverse, the tube shall be constructed according to the criteria of Section 2.7 and shall be assigned a baseline coefficient value of 0.99. If the standard pitot tube is used as part of an assembly, the tube shall be in an interference-free arrangement (subject to the approval of the Administrator).

4.3 Temperature Gauges. After each field use, calibrate dial thermometers, liquid-filled bulb thermometers, thermocouple-potentiometer systems, and other gauges at a temperature within 10 percent of the average absolute stack temperature. For temperatures up to 405° C (761° F), use an ASTM mercury-in-glass reference thermometer, or equivalent, as a reference; alternatively, either a reference thermocouple and potentiometer (calibrated by NBS) or thermometric fixed points, e.g., ice bath and boiling water (corrected for barometric pressure) may be used. For temperatures above 405° C (761° F), use an NBS-calibrated reference thermocouple-potentiometer system or an alternate reference, subject to the approval of the Administrator.

If, during calibration, the absolute temperatures measured with the gauge being calibrated and the reference gauge agree within 1.5 percent, the temperature data taken in the field shall be considered valid. Otherwise, the pollutant emission test shall either be considered invalid or adjustments (if appropriate) of the test results shall be made, subject to the approval of the Administrator.

4.4 Barometer. Calibrate the barometer used against a mercury barometer.

5. *Calculations*

Carry out calculations, retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after final calculation.

5.1 Nomenclature.

A = Cross-sectional area of stack, m² (ft²).

B_{ws} = Water vapor in the gas stream (from Method 5 or Reference Method 4), proportion by volume.

C_p = Pitot tube coefficient, dimensionless.

K_p = Pitot tube constant,

$$34.97\ \frac{\text{m}}{\text{sec}}\left[\frac{(\text{g/g-mole})(\text{mm Hg})}{(^\circ\text{K})(\text{mm H}_2\text{O})}\right]^{1/2}$$

for the metric system and

$$85.49\ \frac{\text{ft}}{\text{sec}}\left[\frac{(\text{lb/lb-mole})(\text{in. Hg})}{(^\circ\text{R})(\text{in. H}_2\text{O})}\right]^{1/2}$$

for the English system.

M_d = Molecular weight of stack gas, dry basis (see Section 3.6) g/g-mole (lb/lb-mole).

M_s = Molecular weight of stack gas, wet basis, g/g-mole (lb/lb-mole).

$= M_d(1-B_{ws})+18.0\,B_{ws}$ Equation 2-5

P_{bar} = Barometric pressure at measurement site, mm Hg (in. Hg).

P_g = Stack static pressure, mm Hg (in. Hg).

P_s = Absolute stack gas pressure, mm Hg (in. Hg).

$= P_{bar}+P_g$ Equation 2-6

P_{std} = Standard absolute pressure, 760 mm Hg (29.92 in. Hg).

Q_{sd} = Dry volumetric stack gas flow rate corrected to standard conditions, dscm/hr (dscf/hr).

t_s = Stack temperature, °C (°F).

T_s = Absolute stack temperature, °K (°R).

$= 273+t_s$ for metric Equation 2-7

$= 460+t_s$ for English Equation 2-8

T_{std} = Standard absolute temperature, 293°K (528° R)

v_s = Average stack gas velocity, m/sec (ft/sec).

Δp = Velocity head of stack gas, mm H₂O (in. H₂O).

3,600 = Conversion factor, sec/hr.

18.0 = Molecular weight of water, g/g-mole (lb-lb-mole).

5.2 Average stack gas velocity.

$$v_s = K_p C_p (\sqrt{\Delta p})_{avg} \sqrt{\frac{T_{s(avg)}}{P_s M_s}}$$

Equation 2-9

5.3 Average stack gas dry volumetric flow rate.

$$Q_{sd} = 3{,}600(1-B_{ws})v_s A\left(\frac{T_{std}}{T_{s(avg)}}\right)\left(\frac{P_s}{P_{std}}\right)$$

Equation 2-10

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METHOD 3—GAS ANALYSIS FOR CARBON DIOXIDE, OXYGEN, EXCESS AIR, AND DRY MOLECULAR WEIGHT

1. *Principle and Applicability*

1.1 Principle. A gas sample is extracted from a stack, by one of the following methods: (1) single-point, grab sampling; (2) single-point, integrated sampling; or (3) multi-point, integrated sampling. The gas sample is analyzed for percent carbon dioxide (CO_2), percent oxygen (O_2), and, if necessary, percent carbon monoxide (CO). If a dry molecular weight determination is to be made, either an Orsat or a Fyrite[1] analyzer may be used for the analysis; for excess air or emission rate correction factor determination, an Orsat analyzer must be used.

1.2 Applicability. This method is applicable for determining CO_2 and O_2 concentrations, excess air, and dry molecular weight of a sample from a gas stream of a fossil-fuel combustion process. The method may also be applicable to other processes where it has been determined that compounds other than CO_2, O_2, CO, and nitrogen (N_2) are not present in concentrations sufficient to affect the results.

Other methods, as well as modifications to the procedure described herein, are also applicable for some or all of the above determinations. Examples of specific methods and modifications include: (1) a multi-point sampling method using an Orsat analyzer to analyze individual grab samples obtained at each point; (2) a method using CO_2 or O_2 and stoichiometric calculations to determine dry molecular weight and excess air; (3) assigning a value of 30.0 for dry molecular weight, in lieu of actual measurements, for processes burning natural gas, coal, or oil. These methods and modifications may be used, but are subject to the approval of the Administrator.

2. *Apparatus*

As an alternative to the sampling apparatus and systems described herein, other sampling systems (e.g., liquid displacement) may be used provided such systems are capable of obtaining a representative sample and maintaining a constant sampling rate, and are otherwise capable of yielding acceptable results. Use of such systems is subject to the approval of the Administrator.

2.1 Grab Sampling (Figure 3-1).

2.1.1 Probe. The probe should be made of stainless steel or borosilicate glass tubing and should be equipped with an in-stack or out-stack filter to remove particulate matter (a plug of glass wool is satisfactory for this purpose). Any other material inert to O_2, CO_2, CO, and N_2 and resistant to temperature at sampling conditions may be used for the probe; examples of such material are aluminum, copper, quartz glass and Teflon.

2.1.2 Pump. A one-way squeeze bulb, or equivalent, is used to transport the gas sample to the analyzer.

2.2 Integrated Sampling (Figure 3-2).

2.2.1 Probe. A probe such as that described in Section 2.1.1 is suitable.

2.2.2 Condenser. An air-cooled or water-cooled condenser, or other condenser that will not remove O_2, CO_2, CO, and N_2, may be used to remove excess moisture which would interfere with the operation of the pump and flow meter.

2.2.3 Valve. A needle valve is used to adjust sample gas flow rate.

2.2.4 Pump. A leak-free, diaphragm-type pump, or equivalent, is used to transport sample gas to the flexible bag. Install a small surge tank between the pump and rate meter to eliminate the pulsation effect of the diaphragm pump on the rotameter.

2.2.5 Rate Meter. The rotameter, or equivalent rate meter, used should be capable of measuring flow rate to within ±2 percent of the selected flow rate. A flow rate range of 500 to 1000 cm^3/min is suggested.

2.2.6 Flexible Bag. Any leak-free plastic (e.g., Tedlar, Mylar, Teflon) or plastic-coated aluminum (e.g., aluminized Mylar) bag, or equivalent, having a capacity consistent with the selected flow rate and time length of the test run, may be used. A capacity in the range of 55 to 90 liters is suggested.

To leak-check the bag, connect it to a water manometer and pressurize the bag to 5 to 10 cm H_2O (2 to 4 in. H_2O). Allow to stand for 10 minutes. Any displacement in the water manometer indicates a leak. An alternative leak-check method is to pressurize the bag to 5 to 10 cm H_2O (2 to 4 in. H_2O) and allow to stand overnight. A deflated bag indicates a leak.

2.2.7 Pressure Gauge. A water-filled U-tube manometer, or equivalent, of about 28 cm (12 in.) is used for the flexible bag leak-check.

2.2.8 Vacuum Gauge. A mercury manometer, or equivalent, of at least 760 mm Hg (30 in. Hg) is used for the sampling train leak-check.

2.3 Analysis. For Orsat and Fyrite analyzer maintenance and operation procedures, follow the instructions recommended by the manufacturer, unless otherwise specified herein.

2.3.1 Dry Molecular Weight Determination. An Orsat analyzer or Fyrite type combustion gas analyzer may be used.

2.3.2 Emission Rate Correction Factor or Excess Air Determination. An Orsat analyzer must be used. For low CO_2 (less than 4.0 percent) or high O_2 (greater than 15.0 percent) concentrations, the measuring burette of the Orsat must have at least 0.1 percent subdivisions.

3. *Dry Molecular Weight Determination*

Any of the three sampling and analytical procedures described below may be used for determining the dry molecular weight.

3.1 Single-Point, Grab Sampling and Analytical Procedure.

3.1.1 The sampling point in the duct shall either be at the centroid of the cross section or at a point no closer to the walls than 1.00 m (3.3 ft), unless otherwise specified by the Administrator.

3.1.2 Set up the equipment as shown in Figure 3-1, making sure all connections ahead of the analyzer are tight and leak-free. If an Orsat analyzer is used, it is recommended that the analyzer be leaked-checked by following the procedure in Section 5; however, the leak-check is optional.

3.1.3 Place the probe in the stack, with the tip of the probe positioned at the sampling point; purge the sampling line. Draw a sample into the analyzer and immediately analyze it for percent CO_2 and percent O_2. Determine the percentage of the gas that is N_2 and CO by subtracting the sum of the percent CO_2 and percent O_2 from 100 percent. Calculate the dry molecular weight as indicated in Section 6.3.

3.1.4 Repeat the sampling, analysis, and calculation procedures, until the dry molecular weights of any three grab samples differ from their mean by no more than 0.3 g/g-mole (0.3 lb/lb-mole). Average these three molecular weights, and report the results to the nearest 0.1 g/g-mole (lb/lb-mole).

3.2 Single-Point, Integrated Sampling and Analytical Procedure.

3.2.1 The sampling point in the duct shall be located as specified in Section 3.1.1.

3.2.2 Leak-check (optional) the flexible bag as in Section 2.2.6. Set up the equipment as shown in Figure 3-2. Just prior to sampling, leak-check (optional) the train by placing a vacuum gauge at the condenser inlet, pulling a vacuum of at least 250 mm Hg (10 in. Hg), plugging the outlet at the quick disconnect, and then turning off the pump. The vacuum should remain stable for at least 0.5 minute. Evacuate the flexible bag. Connect the probe and place it in the stack, with the tip of the probe positioned at the sampling point; purge the sampling line. Next, connect the bag and make sure that all connections are tight and leak free.

3.2.3 Sample at a constant rate. The sampling run should be simultaneous with, and for the same total length of time as, the pollutant emission rate determination. Collection of at least 30 liters (1.00 ft^3) of sample gas is recommended; however, smaller volumes may be collected, if desired.

3.2.4 Obtain one integrated flue gas sample during each pollutant emission rate determination. Within 8 hours after the sample is taken, analyze it for percent CO_2 and percent O_2 using either an Orsat analyzer or a Fyrite-type combustion gas analyzer. If an Orsat analyzer is used, it is recommended that the Orsat leak-check described in Section 5 be performed before this determination; however, the check is optional. Determine the percentage of the gas that is N_2 and CO by subtracting the sum of the percent CO_2 and percent O_2 from 100 percent. Calculate the dry molecular weight as indicated in Section 6.2.

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[1] Mention of trade names or specific products does not constitute endorsement by the Environmental Protection Agency.

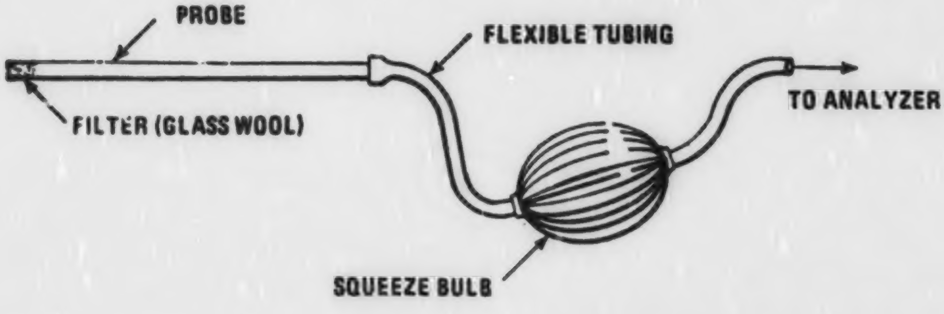

Figure 3-1. Grab-sampling train.

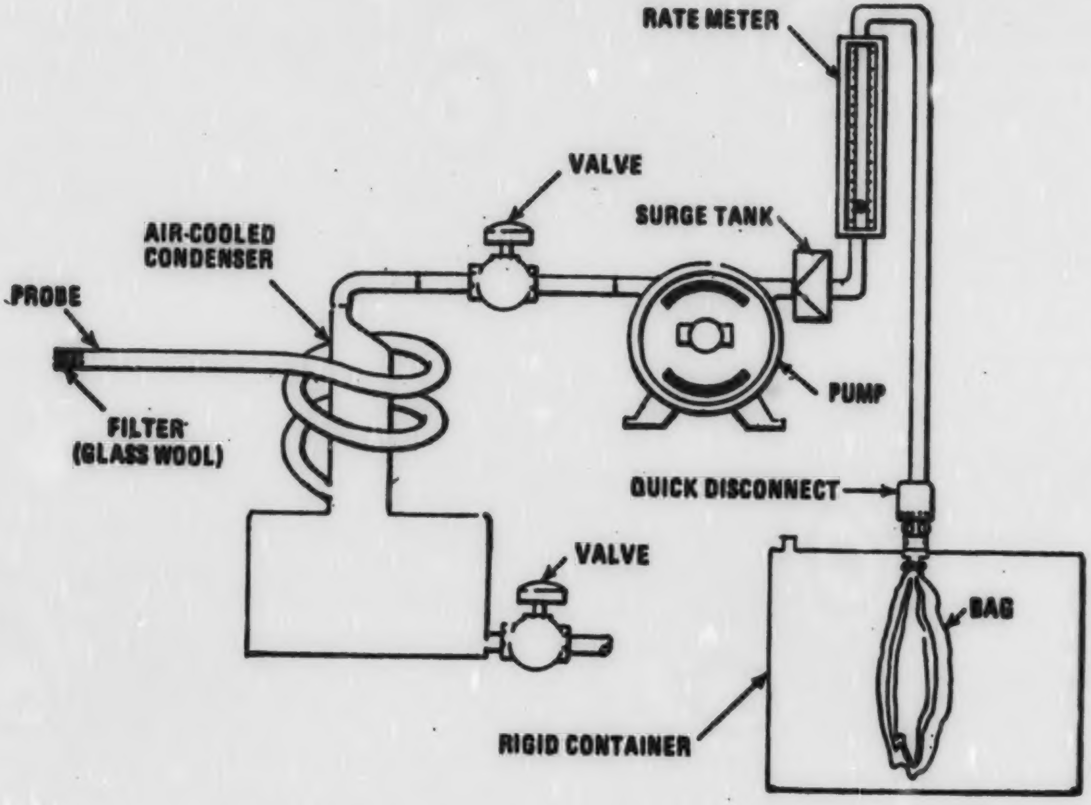
RATE METER
VALVE
SURGE TANK
AIR-COOLED CONDENSER
PROBE
FILTER (GLASS WOOL)
PUMP
QUICK DISCONNECT
VALVE
BAG
RIGID CONTAINER

Figure 3-2. Integrated gas-sampling train.

TIME	TRAVERSE PT.	Q lpm	% DEV.[a]
	AVERAGE		

[a] $\% \text{ DEV} = \left(\frac{Q - Q_{avg}}{Q_{avg}}\right) 100$ (MUST BE $<$10%)

Figure 3-3. Sampling rate data.

3.2.6 Repeat the analysis and calculation procedures until the individual dry molecular weights for any three analyses differ from their mean by no more than 0.3 g/g-mole (0.3 lb/lb-mole). Average these three molecular weights, and report the results to the nearest 0.1 g/g-mole (0.1 lb/lb-mole).

3.3 Multi-Point, Integrated Sampling and Analytical Procedure.

3.3.1 Unless otherwise specified by the Administrator, a minimum of eight traverse points shall be used for circular stacks having diameters less than 0.61 m (24 in.), a minimum of nine shall be used for rectangular stacks having equivalent diameters less than 0.61 m (24 in.), and a minimum of twelve traverse points shall be used for all other cases. The traverse points shall be located according to Method 1. The use of fewer points is subject to approval of the Administrator.

3.3.2 Follow the procedures outlined in Sections 3.2.2 through 3.2.6, except for the following: traverse all sampling points and sample at each point for an equal length of time. Record sampling data as shown in Figure 3-3.

4. *Emission Rate Correction Factor or Excess Air Determination*

NOTE.—A Fyrite-type combustion gas analyzer is not acceptable for excess air or emission rate correction factor determination, unless approved by the Administrator. If both percent CO_2 and percent O_2 are measured, the analytical results of any of the three procedures given below may also be used for calculating the dry molecular weight.

Each of the three procedures below shall be used only when specified in an applicable subpart of the standards. The use of these procedures for other purposes must have specific prior approval of the Administrator.

4.1 Single-Point, Grab Sampling and Analytical Procedure.

4.1.1 The sampling point in the duct shall either be at the centroid of the cross-section or at a point no closer to the walls than 1.00 m (3.3 ft), unless otherwise specified by the Administrator.

4.1.2 Set up the equipment as shown in Figure 3-1, making sure all connections ahead of the analyzer are tight and leak-free. Leak-check the Orsat analyzer according to the procedure described in Section 5. This leak-check is mandatory.

4.1.3 Place the probe in the stack, with the tip of the probe positioned at the sampling point; purge the sampling line. Draw a sample into the analyzer. For emission rate correction factor determination, immediately analyze the sample, as outlined in Sections 4.1.4 and 4.1.5, for percent CO_2 or percent O_2. If excess air is desired, proceed as follows: (1) immediately analyze the sample, as in Sections 4.1.4 and 4.1.5, for percent CO_2, O_2, and CO; (2) determine the percentage of the gas that is N_2 by subtracting the sum of the percent CO_2, percent O_2, and percent CO from 100 percent; and (3) calculate percent excess air as outlined in Section 6.2.

4.1.4 To ensure complete absorption of the CO_2, O_2, or if applicable, CO, make repeated passes through each absorbing solution until two consecutive readings are the same. Several passes (three or four) should be made between readings. (If constant readings cannot be obtained after three consecutive readings, replace the absorbing solution.)

4.1.5 After the analysis is completed, leak-check (mandatory) the Orsat analyzer once again, as described in Section 5. For the results of the analysis to be valid, the Orsat analyzer must pass this leak test before and after the analysis. NOTE.—Since this single-point, grab sampling and analytical procedure is normally conducted in conjunction with a single-point, grab sampling and analytical procedure for a pollutant, only one analysis is ordinarily conducted. Therefore, great care must be taken to obtain a valid sample and analysis. Although in most cases only CO_2 or O_2 is required, it is recommended that both CO_2 and O_2 be measured, and that Citation 5 in the Bibliography be used to validate the analytical data.

4.2 Single-Point, Integrated Sampling and Analytical Procedure.

4.2.1 The sampling point in the duct shall be located as specified in Section 4.1.1.

4.2.2 Leak-check (mandatory) the flexible bag as in Section 2.2.6. Set up the equipment as shown in Figure 3-2. Just prior to sampling, leak-check (mandatory) the train by placing a vacuum gauge at the condenser inlet, pulling a vacuum of at least 250 mm Hg (10 in. Hg), plugging the outlet at the quick disconnect, and then turning off the pump. The vacuum shall remain stable for at least 0.5 minute. Evacuate the flexible bag. Connect the probe and place it in the stack, with the tip of the probe positioned at the sampling point; purge the sampling line. Next, connect the bag and make sure that all connections are tight and leak free.

4.2.3 Sample at a constant rate, or as specified by the Administrator. The sampling run must be simultaneous with, and for the same total length of time as, the pollutant emission rate determination. Collect at least 30 liters (1.00 ft³) of sample gas. Smaller volumes may be collected, subject to approval of the Administrator.

4.2.4 Obtain one integrated flue gas sample during each pollutant emission rate determination. For emission rate correction factor determination, analyze the sample within 4 hours after it is taken for percent CO_2 or percent O_2 (as outlined in Sections 4.2.5 through 4.2.7). The Orsat analyzer must be leak-checked (see Section 5) before the analysis. If excess air is desired, proceed as follows: (1) within 4 hours after the sample is taken, analyze it (as in Sections 4.2.5 through 4.2.7) for percent CO_2, O_2, and CO; (2) determine the percentage of the gas that is N_2 by subtracting the sum of the percent CO_2, percent O_2, and percent CO from 100 percent; (3) calculate percent excess air, as outlined in Section 6.2.

4.2.5 To ensure complete absorption of the CO_2, O_2, or if applicable, CO, make repeated passes through each absorbing solution until two consecutive readings are the same. Several passes (three or four) should be made between readings. (If constant readings cannot be obtained after three consecutive readings, replace the absorbing solution.)

4.2.6 Repeat the analysis until the following criteria are met:

4.2.6.1 For percent CO_2, repeat the analytical procedure until the results of any three analyses differ by no more than (a) 0.3 percent by volume when CO_2 is greater than 4.0 percent or (b) 0.2 percent by volume when CO_2 is less than or equal to 4.0 percent. Average the three acceptable values of percent CO_2 and report the results to the nearest 0.1 percent.

4.2.6.2 For percent O_2, repeat the analytical procedure until the results of any three analyses differ by no more than (a) 0.3 percent by volume when O_2 is less than 15.0 percent or (b) 0.2 percent by volume when O_2 is greater than 15.0 percent. Average the three acceptable values of percent O_2 and report the results to the nearest 0.1 percent.

4.2.6.3 For percent CO, repeat the analytical procedure until the results of any three analyses differ by no more than 0.3 percent. Average the three acceptable values of percent CO and report the results to the nearest 0.1 percent.

4.2.7 After the analysis is completed, leak-check (mandatory) the Orsat analyzer once again, as described in Section 5. For the results of the analysis to be valid, the Orsat analyzer must pass this leak test before and after the analysis. Note: Although in most instances only CO_2 or O_2 is required, it is recommended that both CO_2 and O_2 be measured, and that Citation 5 in the Bibliography be used to validate the analytical data.

4.3 Multi-Point, Integrated Sampling and Analytical Procedure.

4.3.1 Both the minimum number of sampling points and the sampling point location shall be as specified in Section 3.3.1 of this method. The use of fewer points than specified is subject to the approval of the Administrator.

4.3.2 Follow the procedures outlined in Sections 4.2.2 through 4.2.7, except for the following: Traverse all sampling points and sample at each point for an equal length of time. Record sampling data as shown in Figure 3-3.

5. *Leak-Check Procedure for Orsat Analyzers*

Moving an Orsat analyzer frequently causes it to leak. Therefore, an Orsat analyzer should be thoroughly leak-checked on site before the flue gas sample is introduced into it. The procedure for leak-checking an Orsat analyzer is:

5.1.1 Bring the liquid level in each pipette up to the reference mark on the capillary tubing and then close the pipette stopcock.

5.1.2 Raise the leveling bulb sufficiently to bring the confining liquid meniscus onto the graduated portion of the burette and then close the manifold stopcock.

5.1.3 Record the meniscus position.

5.1.4 Observe the meniscus in the burette and the liquid level in the pipette for movement over the next 4 minutes.

5.1.5 For the Orsat analyzer to pass the leak-check, two conditions must be met.

5.1.5.1 The liquid level in each pipette must not fall below the bottom of the capillary tubing during this 4-minute interval.

5.1.5.2 The meniscus in the burette must not change by more than 0.2 ml during this 4-minute interval.

5.1.6 If the analyzer fails the leak-check procedure, all rubber connections and stopcocks should be checked until the cause of the leak is identified. Leaking stopcocks must be disassembled, cleaned, and regreased. Leaking rubber connections must be replaced. After the analyzer is reassembled, the leak-check procedure must be repeated.

6. *Calculations*

6.1 Nomenclature.

M_d = Dry molecular weight, g/g-mole (lb/lb-mole).
%EA = Percent excess air.
$\%CO_2$ = Percent CO_2 by volume (dry basis).
$\%O_2$ = Percent O_2 by volume (dry basis).
%CO = Percent CO by volume (dry basis).
$\%N_2$ = Percent N_2 by volume (dry basis).
0.264 = Ratio of O_2 to N_2 in air, v/v.
0.280 = Molecular weight of N_2 or CO, divided by 100.
0.320 = Molecular weight of O_2 divided by 100.
0.440 = Molecular weight of CO_2 divided by 100.

6.2 Percent Excess Air. Calculate the percent excess air (if applicable), by substituting the appropriate values of percent O_2, CO, and N_2 (obtained from Section 4.1.3 or 4.2.4) into Equation 3-1.

$$\%EA = \left[\frac{\%O_2 - 0.5\%CO}{0.264\,\%N_2 - (\%O_2 - 0.5\,\%CO)}\right]100$$

Equation 3-1

NOTE.—The equation above assumes that ambient air is used as the source of O_2 and that the fuel does not contain appreciable amounts of N_2 (as do coke oven or blast furnace gases). For those cases when appreciable amounts of N_2 are present (coal, oil, and natural gas do not contain appreciable amounts of N_2) or when oxygen enrichment is used, alternate methods, subject to approval of the Administrator, are required.

6.3 Dry Molecular Weight. Use Equation 3-2 to calculate the dry molecular weight of the stack gas.

$$M_d = 0.440(\%CO_2) + 0.320(\%O_2) + 0.280(\%N_2 + \%CO)$$

Equation 3-2

NOTE.—The above equation does not consider argon in air (about 0.9 percent, molecular weight of 37.7). A negative error of about 0.4 percent is introduced. The tester may opt to include argon in the analysis using procedures subject to approval of the Administrator.

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METHOD 4—DETERMINATION OF MOISTURE CONTENT IN STACK GASES

1. *Principle and Applicability*

1.1 Principle. A gas sample is extracted at a constant rate from the source; moisture is removed from the sample stream and determined either volumetrically or gravimetrically.

1.2 Applicability. This method is applicable for determining the moisture content of stack gas.

Two procedures are given. The first is a reference method, for accurate determinations of moisture content (such as are needed to calculate emission data). The second is an approximation method, which provides estimates of percent moisture to aid in setting isokinetic sampling rates prior to a pollutant emission measurement run. The approximation method described herein is only a suggested approach; alternative means for approximating the moisture content, e.g., drying tubes, wet bulb-dry bulb techniques, condensation techniques, stoichiometric calculations, previous experience, etc., are also acceptable.

The reference method is often conducted simultaneously with a pollutant emission measurement run; when it is, calculation of percent isokinetic, pollutant emission rate, etc., for the run shall be based upon the results of the reference method or its equivalent; these calculations shall not be based upon the results of the approximation method, unless the approximation method is shown, to the satisfaction of the Administrator, U.S. Environmental Protection Agency, to be capable of yielding results within 1 percent H_2O of the reference method.

NOTE.—The reference method may yield questionable results when applied to saturated gas streams or to streams that contain water droplets. Therefore, when these conditions exist or are suspected, a second determination of the moisture content shall be made simultaneously with the reference method, as follows: Assume that the gas stream is saturated. Attach a temperature sensor [capable of measuring to ±1° C (2° F)] to the reference method probe. Measure the stack gas temperature at each traverse point (see Section 2.2.1) during the reference method traverse; calculate the average stack gas temperature. Next, determine the moisture percentage, either by: (1) using a psychrometric chart and making appropriate corrections if stack pressure is different from that of the chart, or (2) using saturation vapor pressure tables. In cases where the psychrometric chart or the saturation vapor pressure tables are not applicable (based on evaluation of the process), alternate methods, subject to the approval of the Administrator, shall be used.

2. *Reference Method*

The procedure described in Method 5 for determining moisture content is acceptable as a reference method.

2.1 Apparatus. A schematic of the sampling train used in this reference method is shown in Figure 4-1. All components shall be maintained and calibrated according to the procedure outlined in Method 5.

2.1.1 Probe. The probe is constructed of stainless steel or glass tubing, sufficiently heated to prevent water condensation, and is equipped with a filter, either in-stack (e.g., a plug of glass wool inserted into the end of the probe) or heated out-stack (e.g., as described in Method 5), to remove particulate matter.

When stack conditions permit, other metals or plastic tubing may be used for the probe, subject to the approval of the Administrator.

2.1.2 Condenser. The condenser consists of four impingers connected in series with ground glass, leak-free fittings or any similarly leak-free non-contaminating fittings. The first, third, and fourth impingers shall be of the Greenburg-Smith design, modified by replacing the tip with a 1.3 centimeter (½ inch) ID glass tube extending to about 1.3 cm (½ in.) from the bottom of the flask. The second impinger shall be of the Greenburg-Smith design with the standard tip. Modifications (e.g., using flexible connections between the impingers, using materials other than glass, or using flexible vacuum lines to connect the filter holder to the condenser) may be used, subject to the approval of the Administrator.

The first two impingers shall contain known volumes of water, the third shall be empty, and the fourth shall contain a known weight of 6- to 16-mesh indicating type silica gel, or equivalent desiccant. If the silica gel has been previously used, dry at 175° C (350° F) for 2 hours. New silica gel may be used as received. A thermometer, capable of measuring temperature to within 1° C (2° F), shall be placed at the outlet of the fourth impinger, for monitoring purposes.

Alternatively, any system may be used (subject to the approval of the Administrator) that cools the sample gas stream and allows measurement of both the water that has been condensed and the moisture leaving the condenser, each to within 1 ml or 1 g. Acceptable means are to measure the condensed water, either gravimetrically or volumetrically, and to measure the moisture leaving the condenser by: (1) monitoring the temperature and pressure at the exit of the condenser and using Dalton's law of partial pressures, or (2) passing the sample gas stream through a tared silica gel (or equivalent desiccant) trap, with exit gases kept below 20° C (68° F), and determining the weight gain.

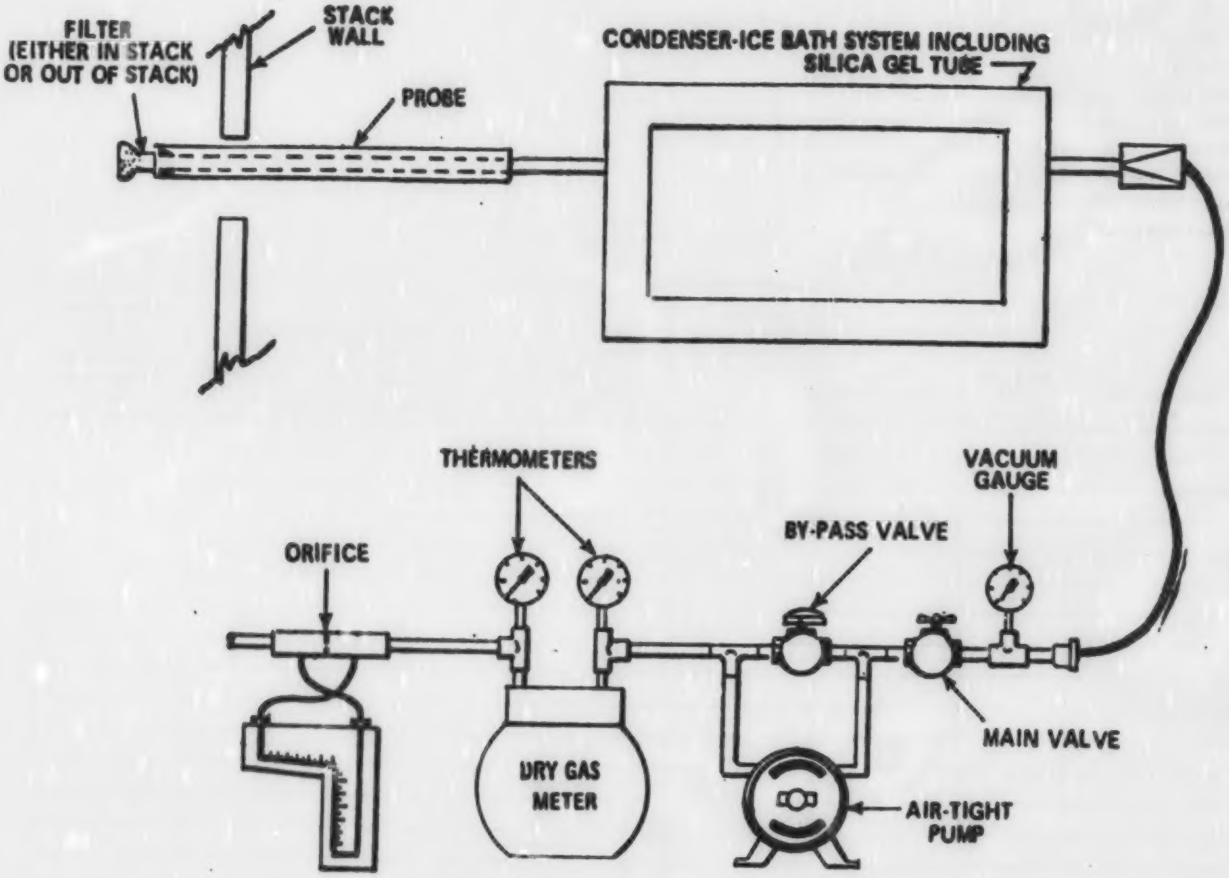

Figure 4-1. Moisture sampling train-reference method.

If means other than silica gel are used to determine the amount of moisture leaving the condenser, it is recommended that silica gel (or equivalent) still be used between the condenser system and pump, to prevent moisture condensation in the pump and metering devices and to avoid the need to make corrections for moisture in the metered volume.

2.1.3 Cooling System. An ice bath container and crushed ice (or equivalent) are used to aid in condensing moisture.

2.1.4 Metering System. This system includes a vacuum gauge, leak-free pump, thermometers capable of measuring temperature to within 3° C (5.4° F), dry gas meter capable of measuring volume to within 2 percent, and related equipment as shown in Figure 4-1. Other metering systems, capable of maintaining a constant sampling rate and determining sample gas volume, may be used, subject to the approval of the Administrator.

2.1.5 Barometer. Mercury, aneroid, or other barometer capable of measuring atmospheric pressure to within 2.5 mm Hg (0.1 in. Hg) may be used. In many cases, the barometric reading may be obtained from a nearby national weather service station, in which case the station value (which is the absolute barometric pressure) shall be requested and an adjustment for elevation differences between the weather station and the sampling point shall be applied at a rate of minus 2.5 mm Hg (0.1 in. Hg) per 30 m (100 ft) elevation increase or vice versa for elevation decrease.

2.1.6 Graduated Cylinder and/or Balance. These items are used to measure condensed water and moisture caught in the silica gel to within 1 ml or 0.5 g. Graduated cylinders shall have subdivisions no greater than 2 ml. Most laboratory balances are capable of weighing to the nearest 0.5 g or less. These balances are suitable for use here.

2.2 Procedure. The following procedure is written for a condenser system (such as the impinger system described in Section 2.1.2) incorporating volumetric analysis to measure the condensed moisture, and silica gel and gravimetric analysis to measure the moisture leaving the condenser.

2.2.1 Unless otherwise specified by the Administrator, a minimum of eight traverse points shall be used for circular stacks having diameters less than 0.61 m (24 in.), a minimum of nine points shall be used for rectangular stacks having equivalent diameters less than 0.61 m (24 in.), and a minimum of twelve travers points shall be used in all other cases. The traverse points shall be located according to Method 1. The use of fewer points is subject to the approval of the Administrator. Select a suitable probe and probe length such that all traverse points can be sampled. Consider sampling from opposite sides of the stack (four total sampling ports) for large stacks, to permit use of shorter probe lengths. Mark the probe with heat resistant tape or by some other method to denote the proper distance into the stack or duct for each sampling point. Place known volumes of water in the first two impingers. Weigh and record the weight of the silica gel to the nearest 0.5 g, and transfer the silica gel to the fourth impinger; alternatively, the silica gel may first be transferred to the impinger, and the weight of the silica gel plus impinger recorded.

2.2.2 Select a total sampling time such that a minimum total gas volume of 0.60 scm (21 scf) will be collected, at a rate no greater than 0.021 m³/min (0.75 cfm). When both moisture content and pollutant emission rate are to be determined, the moisture determination shall be simultaneous with, and for the same total length of time as, the pollutant emission rate run, unless otherwise specified in an applicable subpart of the standards.

2.2.3 Set up the sampling train as shown in Figure 4-1. Turn on the probe heater and (if applicable) the filter heating system to temperatures of about 120° C (248° F), to prevent water condensation ahead of the condenser; allow time for the temperatures to stabilize. Place crushed ice in the ice bath container. It is recommended, but not required, that a leak check be done, as follows: Disconnect the probe from the first impinger or (if applicable) from the filter holder. Plug the inlet to the first impinger (or filter holder) and pull a 380 mm (15 in.) Hg vacuum; a lower vacuum may be used, provided that it is not exceeded during the test. A leakage rate in excess of 4 percent of the average sampling rate or 0.00057 m³/min (0.02 cfm), whichever is less, is unacceptable. Following the leak check, reconnect the probe to the sampling train.

2.2.4 During the sampling run, maintain a sampling rate within 10 percent of constant rate, or as specified by the Administrator. For each run, record the data required on the example data sheet shown in Figure 4-2. Be sure to record the dry gas meter reading at the beginning and end of each sampling time increment and whenever sampling is halted. Take other appropriate readings at each sample point, at least once during each time increment.

2.2.5 To begin sampling, position the probe tip at the first traverse point. Immediately start the pump and adjust the flow to the desired rate. Traverse the cross section, sampling at each traverse point for an equal length of time. Add more ice and, if necessary, salt to maintain a temperature of less than 20° C (68° F) at the silica gel outlet.

2.2.6 After collecting the sample, disconnect the probe from the filter holder (or from the first impinger) and conduct a leak check (mandatory) as described in Section 2.2.3. Record the leak rate. If the leakage rate exceeds the allowable rate, the tester shall either reject the test results or shall correct the sample volume as in Section 6.3 of Method 5. Next, measure the volume of the moisture condensed to the nearest ml. Determine the increase in weight of the silica gel (or silica gel plus impinger) to the nearest 0.5 g. Record this information (see example data sheet, Figure 4-3) and calculate the moisture percentage, as described in 2.3 below.

PLANT________________

LOCATION________________

OPERATOR________________

DATE________________

RUN NO.________________

AMBIENT TEMPERATURE________________

BAROMETRIC PRESSURE________________

PROBE LENGTH m(ft)________________

SCHEMATIC OF STACK CROSS SECTION

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min.	STACK TEMPERATURE °C (°F)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH), mm(in.) H_2O	METER READING GAS SAMPLE VOLUME m^3 (ft^3)	ΔV_m m^3 (ft^3)	GAS SAMPLE TEMPERATURE AT DRY GAS METER		TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER, °C (°F)
						INLET ($T_{m_{in}}$), °C (°F)	OUTLET ($T_{m_{out}}$), °C (°F)	
TOTAL						Avg.	Avg.	
AVERAGE						Avg.		

Figure 4-2. Field moisture determination-reference method.

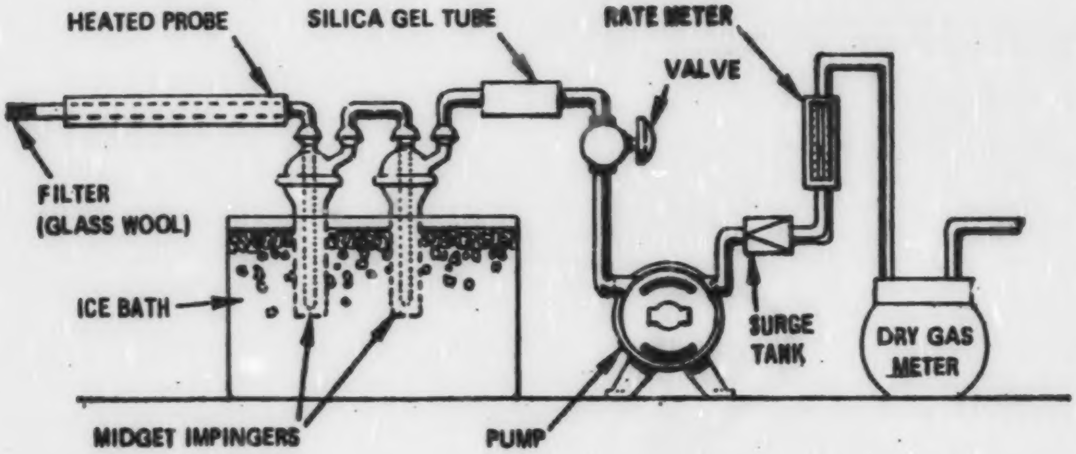
HEATED PROBE
SILICA GEL TUBE
RATE METER
VALVE
FILTER (GLASS WOOL)
ICE BATH
SURGE TANK
DRY GAS METER
MIDGET IMPINGERS
PUMP

Figure 4-4. Moisture-sampling train - approximation method.

LOCATION ______________________ COMMENTS

TEST ______________________

DATE ______________________

OPERATOR ______________________

BAROMETRIC PRESSURE ______________________

CLOCK TIME	GAS VOLUME THROUGH METER, (Vm), m^3 (ft^3)	RATE METER SETTING m^3/min. (ft^3/min.)	METER TEMPERATURE, °C (°F)

Figure 4-5. Field moisture determination - approximation method.

2.3 Calculations. Carry out the following calculations, retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after final calculation.

	IMPINGER VOLUME, ml	SILICA GEL WEIGHT, g
FINAL		
INITIAL		
DIFFERENCE		

Figure 4-3. Analytical data - reference method.

2.3.1 Nomenclature.

B_{ws} = Proportion of water vapor, by volume, in the gas stream.
M_w = Molecular weight of water, 18.0 g/g-mole (18.0 lb/lb-mole).
P_m = Absolute pressure (for this method, same as barometric pressure) at the dry gas meter, mm Hg (in. Hg).
P_{std} = Standard absolute pressure, 760 mm Hg (29.92 in. Hg).
R = Ideal gas constant, 0.06236 (mm Hg) (m³)/(g-mole) (°K) for metric units and 21.85 (in. Hg) (ft³)/(lb-mole) (°R) for English units.
T_m = Absolute temperature at meter, °K (°R).
T_{std} = Standard absolute temperature, 293° K (528° R).
V_m = Dry gas volume measured by dry gas meter, dcm (dcf).
ΔV_m = Incremental dry gas volume measured by dry gas meter at each traverse point, dcm (dcf).
$V_{m(std)}$ = Dry gas volume measured by the dry gas meter, corrected to standard conditions, dscm (dscf).
$V_{wc(std)}$ = Volume of water vapor condensed corrected to standard conditions, scm (scf).
$V_{wsg(std)}$ = Volume of water vapor collected in silica gel corrected to standard conditions, scm (scf).
V_f = Final volume of condenser water, ml.
V_i = Initial volume, if any, of condenser water, ml.
W_f = Final weight of silica gel or silica gel plus impinger, g.
W_i = Initial weight of silica gel or silica gel plus impinger, g.
Y = Dry gas meter calibration factor.
ρ_w = Density of water, 0.9982 g/ml (0.002201 lb/ml).

2.3.2 Volume of water vapor condensed.

$$V_{wc(std)} = \frac{(V_f - V_i)\rho_w R T_{std}}{P_{std} M_w} = K_1 (V_f - V_i)$$

Equation 4-1

where:
K_1 = 0.001333 m³/ml for metric units
= 0.04707 ft³/ml for English units

2.3.3 Volume of water vapor collected in silica gel.

$$V_{wsg(std)} = \frac{(W_f - W_i) R T_{std}}{P_{std} M_w} = K_2 (W_f - W_i)$$

Equation 4-2

where:
K_2 = 0.001335 m³/g for metric units
= 0.04715 ft³/g for English units

2.3.4 Sample gas volume.

$$V_{m(std)} = V_m Y \frac{(P_m)(T_{std})}{(P_{std})(T_m)} = K_3 Y \frac{V_m P_m}{T_m}$$

Equation 4-3

where:
K_3 = 0.3858 °K/mm Hg for metric units
= 17.64 °R/in. Hg for English units

NOTE.—If the post-test leak rate (Section 2.2.6) exceeds the allowable rate, correct the value of V_m in Equation 4-3, as described in Section 6.3 of Method 5.

2.3.5 Moisture Content.

$$B_{ws} = \frac{V_{wc(std)} + V_{wsg(std)}}{V_{wc(std)} + V_{wsg(std)} + V_{m(std)}}$$

Equation 4-4

NOTE.—In saturated or moisture droplet-laden gas streams, two calculations of the moisture content of the stack gas shall be made, one using a value based upon the saturated conditions (see Section 1.2), and another based upon the results of the impinger analysis. The lower of these two values of B_{ws} shall be considered correct.

2.3.6 Verification of constant sampling rate. For each time increment, determine the ΔV_m. Calculate the average. If the value for any time increment differs from the average by more than 10 percent, reject the results and repeat the run.

3. *Approximation Method*

The approximation method described below is presented only as a suggested method (see Section 1.2).

3.1 Apparatus.

3.1.1 Probe. Stainless steel or glass tubing, sufficiently heated to prevent water condensation and equipped with a filter (either in-stack or heated out-stack) to remove particulate matter. A plug of glass wool, inserted into the end of the probe, is a satisfactory filter.

3.1.2 Impingers. Two midget impingers, each with 30 ml capacity, or equivalent.

3.1.3 Ice Bath. Container and ice, to aid in condensing moisture in impingers.

3.1.4 Drying Tube. Tube packed with new or regenerated 6- to 16-mesh indicating-type silica gel (or equivalent desiccant), to dry the sample gas and to protect the meter and pump.

3.1.5 Valve. Needle valve, to regulate the sample gas flow rate.

3.1.6 Pump. Leak-free, diaphragm type, or equivalent, to pull the gas sample through the train.

3.1.7 Volume meter. Dry gas meter, sufficiently accurate to measure the sample volume within 2%, and calibrated over the range of flow rates and conditions actually encountered during sampling.

3.1.8 Rate Meter. Rotameter, to measure the flow range from 0 to 3 lpm (0 to 0.11 cfm).

3.1.9 Graduated Cylinder. 25 ml.

3.1.10 Barometer. Mercury, aneroid, or other barometer, as described in Section 2.1.5 above.

3.1.11 Vacuum Gauge. At least 760 mm Hg (30 in. Hg) gauge, to be used for the sampling leak check.

3.2 Procedure.

3.2.1 Place exactly 5 ml distilled water in each impinger. Assemble the apparatus without the probe as shown in Figure 4-4. Leak check the train by placing a vacuum gauge at the inlet to the first impinger and drawing a vacuum of at least 250 mm Hg (10 in. Hg), plugging the outlet of the rotameter, and then turning off the pump. The vacuum shall remain constant for at least one minute. Carefully release the vacuum gauge before unplugging the rotameter end.

3.2.2 Connect the probe, insert it into the stack, and sample at a constant rate of 2 lpm (0.071 cfm). Continue sampling until the dry gas meter registers about 30 liters (1.1 ft³) or until visible liquid droplets are carried over from the first impinger to the second. Record temperature, pressure, and dry gas meter readings as required by Figure 4-5.

3.2.3 After collecting the sample, combine the contents of the two impingers and measure the volume to the nearest 0.5 ml.

3.3 Calculations. The calculation method presented is designed to estimate the moisture in the stack gas; therefore, other data, which are only necessary for accurate moisture determinations, are not collected. The following equations adequately estimate the moisture content, for the purpose of determining isokinetic sampling rate settings.

3.3.1 Nomenclature.

B_{wm} = Approximate proportion, by volume, of water vapor in the gas stream leaving the second impinger, 0.025.
B_{ws} = Water vapor in the gas stream, proportion by volume.
M_w = Molecular weight of water, 18.0 g/g-mole (18.0 lb/lb-mole)
P_m = Absolute pressure (for this method, same as barometric pressure) at the dry gas meter.
P_{std} = Standard absolute pressure, 760 mm Hg (29.92 in. Hg).
R = Ideal gas constant, 0.06236 (mm Hg) (m³)/(g-mole) (°K) for metric units and 21.85 (in. Hg) (ft³)/lb-mole) (°R) for English units.
T_m = Absolute temperature at meter, °K (°R)
T_{std} = Standard absolute temperature, 293° K (528° R)
V_f = Final volume of impinger contents, ml.
V_i = Initial volume of impinger contents, ml.
V_m = Dry gas volume measured by dry gas meter, dcm (dcf).
$V_{m(std)}$ = Dry gas volume measured by dry gas meter, corrected to standard conditions, dscm (dscf).
$V_{wc(std)}$ = Volume of water vapor condensed, corrected to standard conditions, scm (scf).
ρ_w = Density of water, 0.9982 g/ml (0.002201 lb/ml).

3.3.2 Volume of water vapor collected.

$$V_{wc} = \frac{(V_f - V_i)\rho_w R T_{std}}{P_{std} M_w} = K_1 (V_f - V_i)$$

Equation 4-5

where:
K_1 = 0.001333 m³/ml for metric units
= 0.04707 ft³/ml for English units.

3.3.3 Gas volume.

$$V_{m(std)} = V_m \left(\frac{P_m}{P_{std}}\right)\left(\frac{T_{std}}{T_m}\right) = K_3 \frac{V_m P_m}{T_m}$$

Equation 4-6

where:
K_3 = 0.3858 °K/mm Hg for metric units
= 17.64 °R/in. Hg for English units

3.3.4 Approximate moisture content.

$$B_{ws} = \frac{V_{wc}}{V_{wc} + V_{m(std)}} + B_{wm} = \frac{V_{wc}}{V_{wc} + V_{m(std)}} + (0.025)$$

Equation 4-7

4. *Calibration*

4.1 For the reference method, calibrate equipment as specified in the following sections of Method 5: Section 5.3 (metering system); Section 5.5 (temperature gauges); and Section 5.7 (barometer). The recommended leak check of the metering system (Section 5.6 of Method 5) also applies to the reference method. For the approximation method, use the procedures outlined in Section 5.1.1 of Method 6 to calibrate the metering system, and the procedure of Method 5, Section 5.7 to calibrate the barometer.

5. *Bibliography*

1. Air Pollution Engineering Manual (Second Edition). Danielson, J. A. (ed.). U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, N.C. Publication No. AP-40. 1973.

2. Devorkin, Howard, et al. Air Pollution Source Testing Manual. Air Pollution Control District, Los Angeles, Calif. November, 1963.

3. Methods for Determination of Velocity, Volume, Dust and Mist Content of Gases. Western Precipitation Division of Joy Manufacturing Co., Los Angeles, Calif. Bulletin WP-50. 1968.

METHOD 5—DETERMINATION OF PARTICULATE EMISSIONS FROM STATIONARY SOURCES

1. *Principle and Applicability*

1.1 Principle. Particulate matter is withdrawn isokinetically from the source and collected on a glass fiber filter maintained at a temperature in the range of [illegible] or such other temperature as specified by an applicable subpart of the standards or approved by the Administrator, U.S. Environmental Protection Agency, for a particular application. The particulate mass, which includes any material that condenses at or above the filtration temperature, is determined gravimetrically after removal of uncombined water.

1.2 Applicability. This method is applicable for the determination of particulate emissions from stationary sources.

2. *Apparatus*

2.1 Sampling Train. A schematic of the sampling train used in this method is shown in Figure 5-1. Complete construction details are given in APTD-[illegible] (Citation 2 in Section 7); commercial models of this train are also available. For changes from APTD-[illegible] and for allowable modifications of the train shown in Figure 5-1, see the following subsections.

The operating and maintenance procedures for the sampling train are described in APTD-[illegible] (Citation 3 in Section 7). [illegible] the following components:

2.1.1 [illegible] to the approval of the Administrator.

[illegible]

2.1.4 Differential Pressure Gauge. Inclined manometer or equivalent device (two), as described in Section 2.2 of Method 2. One manometer shall be used for velocity head (Δp) readings, and the other, for orifice differential pressure readings.

2.1.5 Filter Holder. Borosilicate glass, with a glass frit filter support and a silicone rubber gasket. Other materials of construction (e.g., stainless steel, Teflon, Viton) may be used, subject to approval of the Administrator. The holder design shall provide a positive seal against leakage from the outside or around the filter. The holder shall be attached immediately at the outlet of the probe (or cyclone, if used).

2.1.6 Filter Heating System. Any heating system capable of maintaining a temperature around the filter holder during sampling of [illegible] or such other temperature as specified by an applicable subpart of the standards or approved by the Administrator for a particular application. Alternatively, the tester may opt to operate the equipment at a temperature lower than that specified. A temperature gauge capable of measuring temperature to within 3° C (5.4° F) shall be installed so that the temperature around the filter holder can be regulated and monitored during sampling. Heating systems other than the one shown in APTD-[illegible] may be used.

2.1.7 Condenser. The following system shall be used to determine the stack gas moisture content: Four impingers connected in series with leak-free ground glass fittings or any similar leak-free noncontaminating fittings. [illegible] with 1.3 cm (½ in.) ID glass tube extending to about 1.3 cm (½ in.) from the bottom of the flask. [illegible] subject to the approval of the Administrator. [illegible] (Section 4.1.3), the third shall be empty, and the [illegible]

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[1] Mention of trade names or specific products does not constitute endorsement by the Environmental Protection Agency.

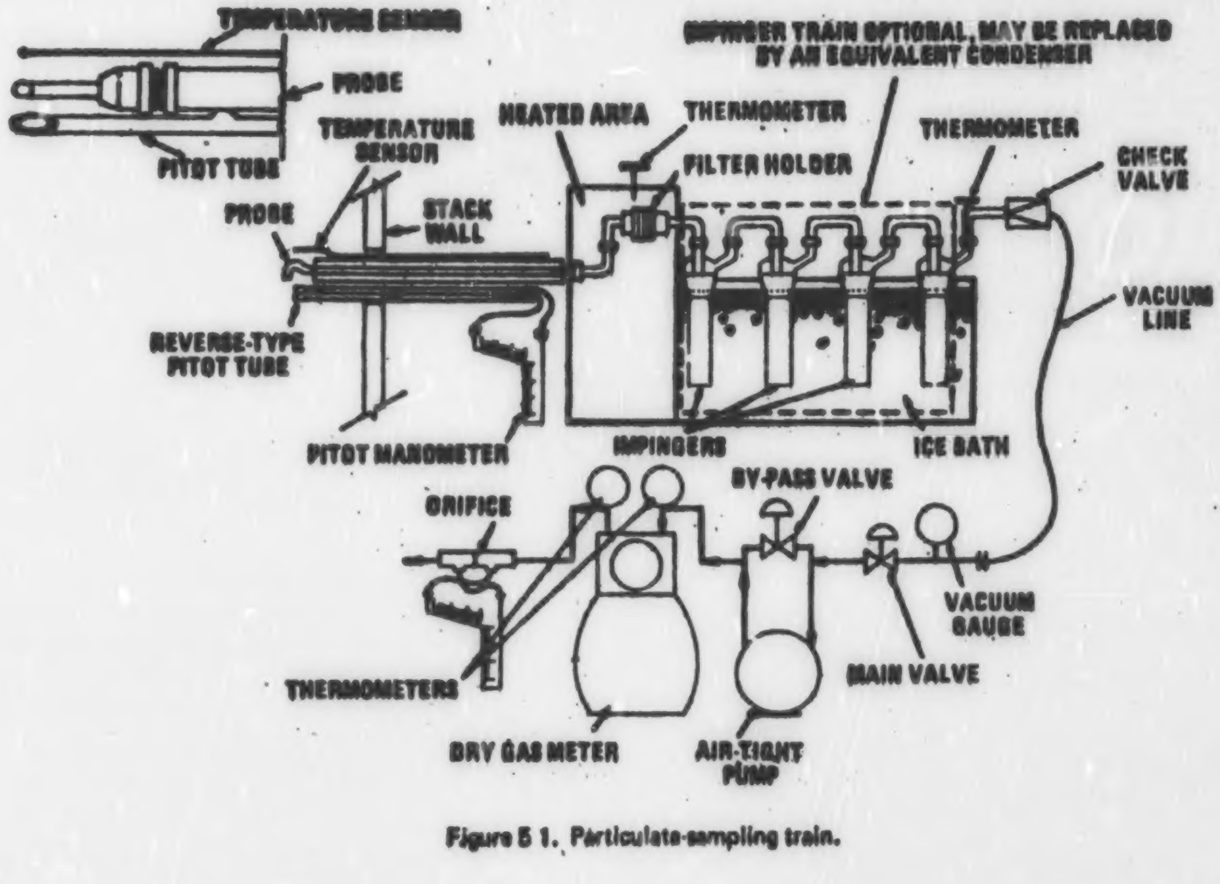
TEMPERATURE SENSOR
PROBE
PITOT TUBE
IMPINGER TRAIN OPTIONAL, MAY BE REPLACED BY AN EQUIVALENT CONDENSER
HEATED AREA
THERMOMETER
FILTER HOLDER
THERMOMETER
CHECK VALVE
TEMPERATURE SENSOR
PROBE
STACK WALL
REVERSE-TYPE PITOT TUBE
VACUUM LINE
PITOT MANOMETER
IMPINGERS
ICE BATH
BY-PASS VALVE
ORIFICE
VACUUM GAUGE
MAIN VALVE
THERMOMETERS
DRY GAS METER
AIR-TIGHT PUMP

Figure 5 1. Particulate-sampling train.

ing temperature to within 1° C (2° F) shall be placed at the outlet of the fourth impinger for monitoring purposes.

Alternatively, any system that cools the sample gas stream and allows measurement of the water condensed and moisture leaving the condenser, each to within 1 ml or 1 g may be used, subject to the approval of the Administrator. Acceptable means are to measure the condensed water either gravimetrically or volumetrically and to measure the moisture leaving the condenser by: (1) monitoring the temperature and pressure at the exit of the condenser and using Dalton's law of partial pressures; or (2) passing the sample gas stream through a tared silica gel (or equivalent desiccant) trap with exit gases kept below 20° C (68° F) and determining the weight gain.

If means other than silica gel are used to determine the amount of moisture leaving the condenser, it is recommended that silica gel (or equivalent) still be used between the condenser system and pump to prevent moisture condensation in the pump and metering devices and to avoid the need to make corrections for moisture in the metered volume.

NOTE.—If a determination of the particulate matter collected in the impingers is desired in addition to moisture content, the impinger system described above shall be used, without modification. Individual States or control agencies requiring this information shall be contacted as to the sample recovery and analysis of the impinger contents.

2.1.8 Metering System. Vacuum gauge, leak-free pump, thermometers capable of measuring temperature to within 3° C (5.4° F), dry gas meter capable of measuring volume to within 2 percent, and related equipment, as shown in Figure 5-1. Other metering systems capable of maintaining sampling rates within 10 percent of isokinetic and of determining sample volumes to within 2 percent may be used, subject to the approval of the Administrator. When the metering system is used in conjunction with a pitot tube, the system shall enable checks of isokinetic rates.

Sampling trains utilizing metering systems designed for higher flow rates than that described in APTD-0581 or APTD-0576 may be used provided that the specifications of this method are met.

2.1.9 Barometer. Mercury, aneroid, or other barometer capable of measuring atmospheric pressure to within 2.5 mm Hg (0.1 in. Hg). In many cases, the barometric reading may be obtained from a nearby national weather service station, in which case the station value (which is the absolute barometric pressure) shall be requested and an adjustment for elevation differences between the weather station and sampling point shall be applied at a rate of minus 2.5 mm Hg (0.1 in. Hg) per 30 m (100 ft) elevation increase or vice versa for elevation decrease.

2.1.10 Gas Density Determination Equipment. Temperature sensor and pressure gauge, as described in Sections 2.3 and 2.4 of Method 2, and gas analyzer, if necessary, as described in Method 3. The temperature sensor shall, preferably, be permanently attached to the pitot tube or sampling probe in a fixed configuration, such that the tip of the sensor extends beyond the leading edge of the probe sheath and does not touch any metal. Alternatively, the sensor may be attached just prior to use in the field. Note, however, that if the temperature sensor is attached in the field, the sensor must be placed in an interference-free arrangement with respect to the Type S pitot tube openings (see Method 2, Figure 2-7). As a second alternative, if a difference of not more than 1 percent in the average velocity measurement is to be introduced, the temperature gauge need not be attached to the probe or pitot tube. (This alternative is subject to the approval of the Administrator.)

2.2 Sample Recovery. The following items are needed:

2.2.1 Probe-Liner and Probe-Nozzle Brushes. Nylon bristle brushes with stainless steel wire handles. The probe brush shall have extensions (at least as long as the probe) of stainless steel, Nylon, Teflon, or similarly inert material. The brushes shall be properly sized and shaped to brush out the probe liner and nozzle.

2.2.2 Wash Bottles—Two. Glass wash bottles are recommended; polyethylene wash bottles may be used at the option of the tester. It is recommended that acetone not be stored in polyethylene bottles for longer than a month.

2.2.3 Glass Sample Storage Containers. Chemically resistant, borosilicate glass bottles, for acetone washes, 500 ml or 1000 ml. Screw cap liners shall either be rubber-backed Teflon or shall be constructed so as to be leak-free and resistant to chemical attack by acetone. (Narrow mouth glass bottles have been found to be less prone to leakage.) Alternatively, polyethylene bottles may be used.

2.2.4 Petri Dishes. For filter samples, glass or polyethylene, unless otherwise specified by the Administrator.

2.2.5 Graduated Cylinder and/or Balance. To measure condensed water to within 1 ml or 1 g. Graduated cylinders shall have subdivisions no greater than 2 ml. Most laboratory balances are capable of weighing to the nearest 0.5 g or less. Any of these balances is suitable for use here and in Section 2.3.4.

2.2.6 Plastic Storage Containers. Air-tight containers to store silica gel.

2.2.7 Funnel and Rubber Policeman. To aid in transfer of silica gel to container; not necessary if silica gel is weighed in the field.

2.2.8 Funnel. Glass or polyethylene, to aid in sample recovery.

2.3 Analysis. For analysis, the following equipment is needed.

2.3.1 Glass Weighing Dishes.

2.3.2 Desiccator.

2.3.3 Analytical Balance. To measure to within 0.1 mg.

2.3.4 Balance. To measure to within 0.5 g.

2.3.5 Beakers. 250 ml.

2.3.6 Hygrometer. To measure the relative humidity of the laboratory environment.

2.3.7 Temperature Gauge. To measure the temperature of the laboratory environment.

3. Reagents

3.1 Sampling. The reagents used in sampling are as follows:

3.1.1 Filters. Glass fiber filters, without organic binder, exhibiting at least 99.95 percent efficiency ($\leq$0.05 percent penetration) on 0.3-micron dioctyl phthalate smoke particles. The filter efficiency test shall be conducted in accordance with ASTM standard method D 2986-71. Test data from the supplier's quality control program are sufficient for this purpose.

3.1.2 Silica Gel. Indicating type, 6 to 16 mesh. If previously used, dry at 175° C (350° F) for 2 hours. New silica gel may be used as received. Alternatively, other types of desiccants (equivalent or better) may be used, subject to the approval of the Administrator.

3.1.3 Water. When analysis of the material caught in the impingers is required, distilled water shall be used. Run blanks prior to field use to eliminate a high blank on test samples.

3.1.4 Crushed Ice.

3.1.5 Stopcock Grease. Acetone-insoluble, heat-stable silicone grease. This is not necessary if screw-on connectors with Teflon sleeves, or similar, are used. Alternatively, other types of stopcock grease may be used, subject to the approval of the Administrator.

3.2 Sample Recovery. Acetone—reagent grade, $\leq$0.001 percent residue, in glass bottles—is required. Acetone from metal containers generally has a high residue blank and should not be used. Sometimes, suppliers transfer acetone to glass bottles from metal containers; thus, acetone blanks shall be run prior to field use and only acetone with low blank values ($\leq$0.001 percent) shall be used. In no case shall a blank value of greater than 0.001 percent of the weight of acetone used be subtracted from the sample weight.

3.3 Analysis. Two reagents are required for the analysis:

3.3.1 Acetone. Same as 3.2.

3.3.2 Desiccant. Anhydrous calcium sulfate, indicating type. Alternatively, other types of desiccants may be used, subject to the approval of the Administrator.

4. Procedure

4.1 Sampling. The complexity of this method is such that, in order to obtain reliable results, testers should be trained and experienced with the test procedures.

4.1.1 Pretest Preparation. All the components shall be maintained and calibrated according to the procedure described in APTD-0576, unless otherwise specified herein.

Weigh several 200 to 300 g portions of silica gel in air-tight containers to the nearest 0.5 g. Record the total weight of the silica gel plus container, on each container. As an alternative, the silica gel need not be preweighed, but may be weighed directly in its impinger or sampling holder just prior to train assembly.

Check filters visually against light for irregularities and flaws or pinhole leaks. Label filters of the proper diameter on the back side near the edge using numbering machine ink. As an alternative, label the shipping containers (glass or plastic petri dishes) and keep the filters in these containers at all times except during sampling and weighing.

Desiccate the filters at 20±5.6° C (68±10° F) and ambient pressure for at least 24 hours and weigh at intervals of at least 6 hours to a constant weight, i.e., <0.5 mg change from previous weighing; record results to the nearest 0.1 mg. During each weighing the filter must not be exposed to the laboratory atmosphere for a period greater than 2 minutes and a relative humidity above 50 percent. Alternatively (unless otherwise specified by the Administrator), the filters may be oven dried at 105° C (220° F) for 2 to 3 hours, desiccated for 2 hours, and weighed. Procedures other than those described, which account for relative humidity effects, may be used, subject to the approval of the Administrator.

4.1.2 Preliminary Determinations. Select the sampling site and the minimum number of sampling points according to Method 1 or as specified by the Administrator. Determine the stack pressure, temperature, and the range of velocity heads using Method 2; it is recommended that a leak-check of the pitot lines (see Method 2, Section 3.1) be performed. Determine the moisture content using Approximation Method 4 or its alternatives for the purpose of making isokinetic sampling rate settings. Determine the stack gas dry molecular weight, as described in Method 2, Section 3.6; if integrated Method 3 sampling is used for molecular weight determination, the integrated bag sample shall be taken simultaneously with, and for the same total length of time as, the particulate sample run.

Select a nozzle size based on the range of velocity heads, such that it is not necessary to change the nozzle size in order to maintain isokinetic sampling rates. During the run, do not change the nozzle size. Ensure that the proper differential pressure gauge is chosen for the range of velocity heads encountered (see Section 2.2 of Method 2).

Select a suitable probe liner and probe length such that all traverse points can be sampled. For large stacks, consider sampling from opposite sides of the stack to reduce the length of probes.

Select a total sampling time greater than or equal to the minimum total sampling time specified in the test procedures for the specific industry such that (1) the sampling time per point is not less than 2 min (or some greater time interval as specified by the Administrator), and (2) the sample volume taken (corrected to standard conditions) will exceed the required minimum total gas sample volume. The latter is based on an approximate average sampling rate.

It is recommended that the number of minutes sampled at each point be an integer or an integer plus one-half minute, in order to avoid timekeeping errors.

In some circumstances, e.g., batch cycles, it may be necessary to sample for shorter times at the traverse points and to obtain smaller gas sample volumes. In these cases, the Administrator's approval must first be obtained.

4.1.3 Preparation of Collection Train. During preparation and assembly of the sampling train, keep all openings where contamination can occur covered until just prior to assembly or until sampling is about to begin.

Place 100 ml of water in each of the first two impingers, leave the third impinger empty, and transfer approximately 200 to 300 g of preweighed silica gel from its container to the fourth impinger. More silica gel may be used, but care should be taken to ensure that it is not entrained and carried out from the impinger during sampling. Place the container in a clean place for later use in the sample recovery. Alternatively, the weight of the silica gel plus impinger may be determined to the nearest 0.5 g and recorded.

Using a tweezer or clean disposable surgical gloves, place a labeled (identified) and weighed filter in the filter holder. Be sure that the filter is properly centered and the gasket properly placed so as to prevent the sample gas stream from circumventing the filter. Check the filter for tears after assembly is completed.

When glass liners are used, install the selected nozzle using a Viton A O-ring when stack temperatures are less than 260° C (500° F) and an asbestos string gasket when temperatures are higher. See APTD-0576 for details. Other connecting systems using either 316 stainless steel or Teflon ferrules may be used. When metal liners are used, install the nozzle as above or by a leak-free direct mechanical connection. Mark the probe with heat resistant tape or by some other method to denote the proper distance into the stack or duct for each sampling point.

Set up the train as in Figure 5-1, using (if necessary) a very light coat of silicone grease on all ground glass joints, greasing only the outer portion (see APTD-0576) to avoid possibility of contamination by the silicone grease. Subject to the approval of the Administrator, a glass cyclone may be used between the probe and filter holder when the total particulate catch is expected to exceed 100 mg or when water droplets are present in the stack gas.

Place crushed ice around the impingers.

4.1.4 Leak-Check Procedures.

4.1.4.1 Pretest Leak-Check. A pretest leak-check is recommended, but not required. If the tester opts to conduct the pretest leak-check, the following procedure shall be used.

After the sampling train has been assembled, turn on and set the filter and probe heating systems at the desired operating temperatures. Allow time for the temperatures to stabilize. If a Viton A O-ring or other leak-free connection is used in assembling the probe nozzle to the probe liner, leak-check the train at the sampling site by plugging the nozzle and pulling a 380 mm Hg (15 in. Hg) vacuum.

NOTE.—A lower vacuum may be used, provided that it is not exceeded during the test.

If an asbestos string is used, do not connect the probe to the train during the leak-check. Instead, leak-check the train by first plugging the inlet to the filter holder (cyclone, if applicable) and pulling a 380 mm Hg (15 in. Hg) vacuum (see Note immediately above). Then connect the probe to the train and leak-check at about 25 mm Hg (1 in. Hg) vacuum; alternatively, the probe may be leak-checked with the rest of the sampling train, in one step, at 380 mm Hg (15 in. Hg) vacuum. Leakage rates in excess of 4 percent of the average sampling rate or 0.00057 m³/min (0.02 cfm), whichever is less, are unacceptable.

The following leak-check instructions for the sampling train described in APTD-0576 and APTD-0581 may be helpful. Start the pump with bypass valve fully open and coarse adjust valve completely closed. Partially open the coarse adjust valve and slowly close the bypass valve until the desired vacuum is reached. Do not reverse direction of bypass valve; this will cause water to back up into the filter holder. If the desired vacuum is exceeded, either leak-check at this higher vacuum or end the leak check as shown below and start over.

When the leak-check is completed, first slowly remove the plug from the inlet to the probe, filter holder, or cyclone (if applicable) and immediately turn off the vacuum pump. This prevents the water in the impingers from being forced backward into the filter holder and silica gel from being entrained backward into the third impinger.

4.1.4.2 Leak-Checks During Sample Run. If, during the sampling run, a component (e.g., filter assembly or impinger) change becomes necessary, a leak-check shall be conducted immediately before the change is made. The leak-check shall be done according to the procedure outlined in Section 4.1.4.1 above, except that it shall be done at a vacuum equal to or greater than the maximum value recorded up to that point in the test. If the leakage rate is found to be no greater than 0.00057 m³/min (0.02 cfm) or 4 percent of the average sampling rate (whichever is less), the results are acceptable, and no correction will need to be applied to the total volume of dry gas metered; if, however, a higher leakage rate is obtained, the tester shall either record the leakage rate and plan to correct the sample volume as shown in Section 6.3 of this method, or shall void the sampling run.

Immediately after component changes, leak-checks are optional; if such leak-checks are done, the procedure outlined in Section 4.1.4.1 above shall be used.

4.1.4.3 Post-test Leak-Check. A leak-check is mandatory at the conclusion of each sampling run. The leak-check shall be done in accordance with the procedures outlined in Section 4.1.4.1, except that it shall be conducted at a vacuum equal to or greater than the maximum value reached during the sampling run. If the leakage rate is found to be no greater than 0.00057 m³/min (0.02 cfm) or 4 percent of the average sampling rate (whichever is less), the results are acceptable, and no correction need be applied to the total volume of dry gas metered. If, however, a higher leakage rate is obtained, the tester shall either record the leakage rate and correct the sample volume as shown in Section 6.3 of this method, or shall void the sampling run.

4.1.5 Particulate Train Operation. During the sampling run, maintain an isokinetic sampling rate (within 10 percent of true isokinetic unless otherwise specified by the Administrator) and a temperature around the filter of 120±14° C (248±25° F), or such other temperature as specified by an applicable subpart of the standards or approved by the Administrator.

For each run, record the data required on a data sheet such as the one shown in Figure 5-2. Be sure to record the initial dry gas meter reading. Record the dry gas meter readings at the beginning and end of each sampling time increment, when changes in flow rates are made, before and after each leak check, and when sampling is halted.

PLANT ____________________
LOCATION ____________________
OPERATOR ____________________
DATE ____________________
RUN NO. ____________________
SAMPLE BOX NO. ____________________
METER BOX NO. ____________________
METER ΔH@ ____________________
C FACTOR ____________________
PITOT TUBE COEFFICIENT, C_p ____________________

SCHEMATIC OF STACK CROSS SECTION

AMBIENT TEMPERATURE ____________________
BAROMETRIC PRESSURE ____________________
ASSUMED MOISTURE, % ____________________
PROBE LENGTH, m (ft) ____________________
NOZZLE IDENTIFICATION NO. ____________________
AVERAGE CALIBRATED NOZZLE DIAMETER, cm (in.) ____________________
PROBE HEATER SETTING ____________________
LEAK RATE, m³/min (cfm) ____________________
PROBE LINER MATERIAL ____________________
STATIC PRESSURE, mm Hg (in. Hg) ____________________
FILTER NO. ____________________

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min.	VACUUM mm Hg (in. Hg)	STACK TEMPERATURE (T_S) °C (°F)	VELOCITY HEAD (ΔP_S), mm (in.) H_2O	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER mm H_2O (in. H_2O)	GAS SAMPLE VOLUME m³ (ft³)	GAS SAMPLE TEMPERATURE AT DRY GAS METER		FILTER HOLDER TEMPERATURE, °C (°F)	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER, °C (°F)
							INLET °C (°F)	OUTLET °C (°F)		
TOTAL							Avg.	Avg.		
AVERAGE							Avg.			

Figure 5-2. Particulate field data.

Take other readings required by Figure 5-2 at least once at each sample point during each time increment and additional readings when significant changes (20 percent variation in velocity head readings) necessitate additional adjustments in flow rate. Level and zero the manometer. Because the manometer level and zero may drift due to vibrations and temperature changes, make periodic checks during the traverse.

Clean the portholes prior to the test run to minimize the chance of sampling deposited material. To begin sampling, remove the nozzle cap, verify that the filter and probe heating systems are up to temperature, and that the pitot tube and probe are properly positioned. Position the nozzle at the first traverse point with the tip pointing directly into the gas stream. Immediately start the pump and adjust the flow to isokinetic conditions. Nomographs are available, which aid in the rapid adjustment of the isokinetic sampling rate without excessive computations. These nomographs are designed for use when the Type S pitot tube coefficient is 0.85±0.02, and the stack gas equivalent density (dry molecular weight) is equal to 29±4. APTD-0576 details the procedure for using the nomographs. If C_p and M_d are outside the above stated ranges do not use the nomographs unless appropriate steps (see Citation 7 in Section 7) are taken to compensate for the deviations.

When the stack is under significant negative pressure (height of impinger stem), take care to close the coarse adjust valve before inserting the probe into the stack to prevent water from backing into the filter holder. If necessary, the pump may be turned on with the coarse adjust valve closed.

When the probe is in position, block off the openings around the probe and porthole to prevent unrepresentative dilution of the gas stream.

Traverse the stack cross-section, as required by Method 1 or as specified by the Administrator, being careful not to bump the probe nozzle into the stack walls when sampling near the walls or when removing or inserting the probe through the portholes; this minimizes the chance of extracting deposited material.

During the test run, make periodic adjustments to keep the temperature around the filter holder at the proper level; add more ice and, if necessary, salt to maintain a temperature of less than 20° C (68° F) at the condenser/silica gel outlet. Also, periodically check the level and zero of the manometer.

If the pressure drop across the filter becomes too high, making isokinetic sampling difficult to maintain, the filter may be replaced in the midst of a sample run. It is recommended that another complete filter assembly be used rather than attempting to change the filter itself. Before a new filter assembly is installed, conduct a leak-check (see Section 4.1.4.2). The total particulate weight shall include the summation of all filter assembly catches.

A single train shall be used for the entire sample run, except in cases where simultaneous sampling is required in two or more separate ducts or at two or more different locations within the same duct, or, in cases where equipment failure necessitates a change of trains. In all other situations, the use of two or more trains will be subject to the approval of the Administrator.

Note that when two or more trains are used, separate analyses of the front-half and (if applicable) impinger catches from each train shall be performed, unless identical nozzle sizes were used on all trains, in which case, the front-half catches from the individual trains may be combined (as may the impinger catches) and one analysis of front half catch and one analysis of impinger catch may be performed. Consult with the Administrator for details concerning the calculation of results when two or more trains are used.

At the end of the sample run, turn off the coarse adjust valve, remove the probe and nozzle from the stack, turn off the pump, record the final dry gas meter reading, and conduct a post-test leak-check, as outlined in Section 4.1.4.3. Also, leak-check the pitot lines as described in Method 2, Section 3.1; the lines must pass this leak-check, in order to validate the velocity head data.

4.1.6 Calculation of Percent Isokinetic. Calculate percent isokinetic (see Calculations, Section 6) to determine whether the run was valid or another test run should be made. If there was difficulty in maintaining isokinetic rates due to source conditions, consult with the Administrator for possible variance on the isokinetic rates.

4.2 Sample Recovery. Proper cleanup procedure begins as soon as the probe is removed from the stack at the end of the sampling period. Allow the probe to cool.

When the probe can be safely handled, wipe off all external particulate matter near the tip of the probe nozzle and place a cap over it to prevent losing or gaining particulate matter. Do not cap off the probe tip tightly while the sampling train is cooling down as this would create a vacuum in the filter holder, thus drawing water from the impingers into the filter holder.

Before moving the sample train to the cleanup site, remove the probe from the sample train, wipe off the silicone grease, and cap the open outlet of the probe. Be careful not to lose any condensate that might be present. Wipe off the silicone grease from the filter inlet where the probe was fastened and cap it. Remove the umbilical cord from the last impinger and cap the impinger. If a flexible line is used between the first impinger or condenser and the filter holder, disconnect the line at the filter holder and let any condensed water or liquid drain into the impingers or condenser. After wiping off the silicone grease, cap off the filter holder outlet and impinger inlet. Either ground-glass stoppers, plastic caps, or serum caps may be used to close these openings.

Transfer the probe and filter-impinger assembly to the cleanup area. This area should be clean and protected from the wind so that the chances of contaminating or losing the sample will be minimized.

Save a portion of the acetone used for cleanup as a blank. Take 200 ml of this acetone directly from the wash bottle being used and place it in a glass sample container labeled "acetone blank."

Inspect the train prior to and during disassembly and note any abnormal conditions. Treat the samples as follows:

Container No. 1. Carefully remove the filter from the filter holder and place it in its identified petri dish container. Use a pair of tweezers and/or clean disposable surgical gloves to handle the filter. If it is necessary to fold the filter, do so such that the particulate cake is inside the fold. Carefully transfer to the petri dish any particulate matter and/or filter fibers which adhere to the filter holder gasket, by using a dry nylon bristle brush and/or a sharp-edged blade. Seal the container.

Container No. 2. Taking care to see that dust on the outside of the probe or other exterior surfaces does not get into the sample, quantitatively recover particulate matter or any condensate from the probe nozzle, probe fitting, probe liner, and front half of the filter holder by washing these components with acetone and placing the wash in a glass container. Distilled water may be used instead of acetone when approved by the Administrator and shall be used when specified by the Administrator; in these cases, save a water blank and follow the Administrator's directions on analysis. Perform the acetone rinses as follows:

Carefully remove the probe nozzle and clean the inside surface by rinsing with acetone from a wash bottle and brushing with a nylon bristle brush. Brush until the acetone rinse shows no visible particles, after which make a final rinse of the inside surface with acetone.

Brush and rinse the inside parts of the Swagelok fitting with acetone in a similar way until no visible particles remain.

Rinse the probe liner with acetone by tilting and rotating the probe while squirting acetone into its upper end so that all inside surfaces will be wetted with acetone. Let the acetone drain from the lower end into the sample container. A funnel (glass or polyethylene) may be used to aid in transferring liquid washes to the container. Follow the acetone rinse with a probe brush. Hold the probe in an inclined position, squirt acetone into the upper end as the probe brush is being pushed with a twisting action through the probe; hold a sample container underneath the lower end of the probe, and catch any acetone and particulate matter which is brushed from the probe. Run the brush through the probe three times or more until no visible particulate matter is carried out with the acetone or until none remains in the probe liner on visual inspection. With stainless steel or other metal probes, run the brush through in the above prescribed manner at least six times since metal probes have small crevices in which particulate matter can be entrapped. Rinse the brush with acetone, and quantitatively collect these washings in the sample container. After the brushing, make a final acetone rinse of the probe as described above.

It is recommended that two people be used to clean the probe to minimize sample losses. Between sampling runs, keep brushes clean and protected from contamination.

After ensuring that all joints have been wiped clean of silicone grease, clean the inside of the front half of the filter holder by rubbing the surfaces with a nylon bristle brush and rinsing with acetone. Rinse each surface three times or more if needed to remove visible particulate. Make a final rinse of the brush and filter holder. Carefully rinse out the glass cyclone, also (if applicable). After all acetone washings and particulate matter have been collected in the sample container, tighten the lid on the sample container so that acetone will not leak out when it is shipped to the laboratory. Mark the height of the fluid level to determine whether or not leakage occurred during transport. Label the container to clearly identify its contents.

Container No. 3. Note the color of the indicating silica gel to determine if it has been completely spent and make a notation of its condition. Transfer the silica gel from the fourth impinger to its original container and seal. A funnel may make it easier to pour the silica gel without spilling. A rubber policeman may be used as an aid in removing the silica gel from the impinger. It is not necessary to remove the small amount of dust particles that may adhere to the impinger wall and are difficult to remove. Since the gain in weight is to be used for moisture calculations, do not use any water or other liquids to transfer the silica gel. If a balance is available in the field, follow the procedure for container No. 3 in Section 4.3.

Impinger Water. Treat the impingers as follows: Make a notation of any color or film in the liquid catch. Measure the liquid which is in the first three impingers to within ±1 ml by using a graduated cylinder or by weighing it to within ±0.5 g by using a balance (if one is available). Record the volume or weight of liquid present. This information is required to calculate the moisture content of the effluent gas.

Discard the liquid after measuring and recording the volume or weight, unless analysis of the impinger catch is required (see Note, Section 2.1.7).

If a different type of condenser is used, measure the amount of moisture condensed either volumetrically or gravimetrically.

Whenever possible, containers should be shipped in such a way that they remain upright at all times.

4.3 Analysis. Record the data required on a sheet such as the one shown in Figure 5-3. Handle each sample container as follows:

Container No. 1. Leave the contents in the shipping container or transfer the filter and any loose particulate from the sample container to a tared glass weighing dish. Desiccate for 24 hours in a desiccator containing anhydrous calcium sulfate. Weigh to a constant weight and report the results to the nearest 0.1 mg. For purposes of this Section, 4.3, the term "constant weight" means a difference of no more than 0.5 mg or 1 percent of total weight less tare weight, whichever is greater, between two consecutive weighings, with no less than 6 hours of desiccation time between weighings.

Alternatively, the sample may be oven dried at 105° C (220° F) for 2 to 3 hours, cooled in the desiccator, and weighed to a constant weight, unless otherwise specified by the Administrator. The tester may also opt to oven dry the sample at 105° C (220° F) for 2 to 3 hours, weigh the sample, and use this weight as a final weight.

Container No. 2. Note the level of liquid in the container and confirm on the analysis sheet whether or not leakage occurred during transport. If a noticeable amount of leakage has occurred, either void the sample or use methods, subject to the approval of the Administrator, to correct the final results. Measure the liquid in this container either volumetrically to ±1 ml or gravimetrically to ±0.5 g. Transfer the contents to a tared 250-ml beaker and evaporate to dryness at ambient temperature and pressure. Desiccate for 24 hours and weigh to a constant weight. Report the results to the nearest 0.1 mg.

Container No. 3. Weigh the spent silica gel (or silica gel plus impinger) to the nearest 0.5 g using a balance. This step may be conducted in the field.

"Acetone Blank" Container. Measure acetone in this container either volumetrically or gravimetrically. Transfer the acetone to a tared 250-ml beaker and evaporate to dryness at ambient temperature and pressure. Desiccate for 24 hours and weigh to a constant weight. Report the results to the nearest 0.1 mg.

NOTE.—At the option of the tester, the contents of Container No. 2 as well as the acetone blank container may be evaporated at temperatures higher than ambient. If evaporation is done at an elevated temperature, the temperature must be below the boiling point of the solvent; also, to prevent "bumping," the evaporation process must be closely supervised, and the contents of the beaker must be swirled occasionally to maintain an even temperature. Use extreme care, as acetone is highly flammable and has a low flash point.

5. *Calibration*

Maintain a laboratory log of all calibrations.

5.1 Probe Nozzle. Probe nozzles shall be calibrated before their initial use in the field. Using a micrometer, measure the inside diameter of the nozzle to the nearest 0.025 mm (0.001 in.). Make three separate measurements using different diameters each time, and obtain the average of the measurements. The difference between the high and low numbers shall not exceed 0.1 mm (0.004 in.). When nozzles become nicked, dented, or corroded, they shall be reshaped, sharpened, and recalibrated before use. Each nozzle shall be permanently and uniquely identified.

5.2 Pitot Tube. The Type S pitot tube assembly shall be calibrated according to the procedure outlined in Section 4 of Method 2.

5.3 Metering System. Before its initial use in the field, the metering system shall be calibrated according to the procedure outlined in APTD-0576. Instead of physically adjusting the dry gas meter dial readings to correspond to the wet test meter readings, calibration factors may be used to mathematically correct the gas meter dial readings to the proper values. Before calibrating the metering system, it is suggested that a leak-check be conducted. For metering systems having diaphragm pumps, the normal leak-check procedure will not detect leakages within the pump. For these cases the following leak-check procedure is suggested: make a 10-minute calibration run at 0.00057 m^3/min (0.02 cfm); at the end of the run, take the difference of the measured wet test meter and dry gas meter volumes; divide the difference by 10, to get the leak rate. The leak rate should not exceed 0.00057 m^3/min (0.02 cfm).

After each field use, the calibration of the metering system shall be checked by performing three calibration runs at a single, intermediate orifice setting (based on the previous field test), with the vacuum set at the maximum value reached during the test series. To adjust the vacuum, insert a valve between the wet test meter and the inlet of the metering system. Calculate the average value of the calibration factor. If the calibration has changed by more than 5 percent, recalibrate the meter over the full range of orifice settings, as outlined in APTD-0576.

Alternative procedures, e.g., using the orifice meter coefficients, may be used, subject to the approval of the Administrator.

NOTE.—If the dry gas meter coefficient values obtained before and after a test series differ by more than 5 percent, the test series shall either be voided, or calculations for the test series shall be performed using whichever meter coefficient value (i.e., before or after) gives the lower value of total sample volume.

5.4 Probe Heater Calibration. The probe heating system shall be calibrated before its initial use in the field according to the procedure outlined in APTD-0576. Probes constructed according to APTD-0581 need not be calibrated if the calibration curves in APTD-0576 are used.

5.5 Temperature Gauges. Use the procedure in Section 4.3 of Method 2 to calibrate in-stack temperature gauges. Dial thermometers, such as are used for the dry gas meter and condenser outlet, shall be calibrated against mercury-in-glass thermometers.

5.6 Leak Check of Metering System Shown in Figure 5-1. That portion of the sampling train from the pump to the orifice meter should be leak checked prior to initial use and after each shipment. Leakage after the pump will result in less volume being recorded than is actually sampled. The following procedure is suggested (see Figure 5-4): Close the main valve on the meter box. Insert a one-hole rubber stopper with rubber tubing attached into the orifice exhaust pipe. Disconnect and vent the low side of the orifice manometer. Close off the low side orifice tap. Pressurize the system to 13 to 18 cm (5 to 7 in.) water column by blowing into the rubber tubing. Pinch off the tubing and observe the manometer for one minute. A loss of pressure on the manometer indicates a leak in the meter box; leaks, if present, must be corrected.

5.7 Barometer. Calibrate against a mercury barometer.

6. *Calculations*

Carry out calculations, retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after the final calculation. Other forms of the equations may be used as long as they give equivalent results.

Plant ____________________

Date ____________________

Run No. ____________________

Filter No. ____________________

Amount liquid lost during transport ____________________

Acetone blank volume, ml ____________________

Acetone wash volume, ml ____________________

Acetone blank concentration, mg/mg (equation 5-4) ____________________

Acetone wash blank, mg (equation 5-5) ____________________

CONTAINER NUMBER	WEIGHT OF PARTICULATE COLLECTED, mg		
	FINAL WEIGHT	TARE WEIGHT	WEIGHT GAIN
1			
2			
TOTAL			

Less acetone blank	
Weight of particulate matter	

	VOLUME OF LIQUID WATER COLLECTED	
	IMPINGER VOLUME, ml	SILICA GEL WEIGHT, g
FINAL		
INITIAL		
LIQUID COLLECTED		
TOTAL VOLUME COLLECTED		g* ml

* CONVERT WEIGHT OF WATER TO VOLUME BY DIVIDING TOTAL WEIGHT INCREASE BY DENSITY OF WATER (1g/ml).

$$\frac{\text{INCREASE, g}}{1\ \text{g/ml}} = \text{VOLUME WATER, ml}$$

Figure 5-3. Analytical data.

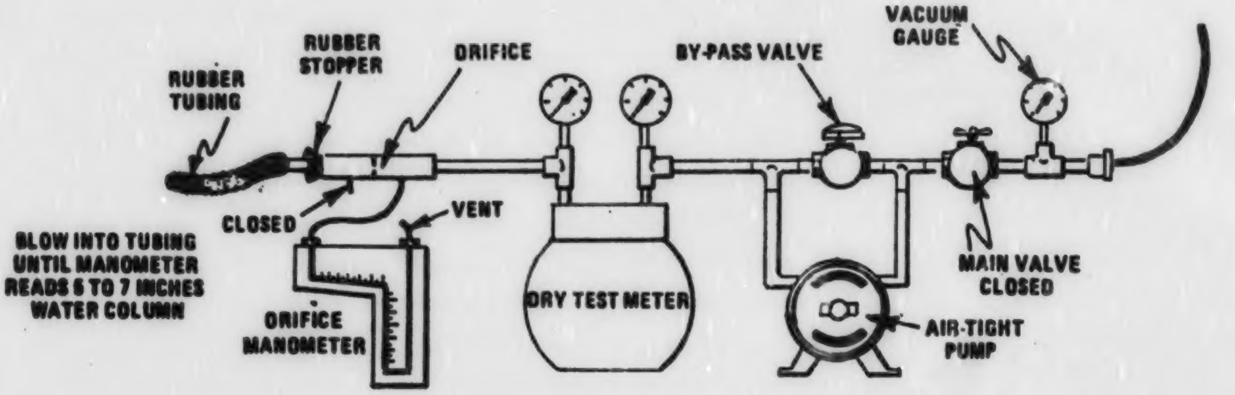

Figure 5-4. Leak check of meter box.

6.1 Nomenclature

A_n = Cross-sectional area of nozzle, m² (ft²).

B_{ws} = Water vapor in the gas stream, proportion by volume.

C_a = Acetone blank residue concentrations, mg/g.

c_s = Concentration of particulate matter in stack gas, dry basis, corrected to standard conditions, g/dscm (g/dscf).

I = Percent of isokinetic sampling.

L_a = Maximum acceptable leakage rate for either a pretest leak check or for a leak check following a component change; equal to 0.00057 m³/min (0.02 cfm) or 4 percent of the average sampling rate, whichever is less.

L_i = Individual leakage rate observed during the leak check conducted prior to the "i^{th}" component change (i=1, 2, 3 . . . . n), m³/min (cfm).

L_p = Leakage rate observed during the post-test leak check, m³/min (cfm).

m_n = Total amount of particulate matter collected, mg.

M_w = Molecular weight of water, 18.0 g/g-mole (18.0 lb/lb-mole).

m_a = Mass of residue of acetone after evaporation, mg.

P_{bar} = Barometric pressure at the sampling site, mm Hg (in. Hg).

P_s = Absolute stack gas pressure, mm Hg (in. Hg).

P_{std} = Standard absolute pressure, 760 mm Hg (29.92 in. Hg).

R = Ideal gas constant, 0.06236 mm Hg-m³/°K-g-mole (21.85 in. Hg-ft³/°R-lb-mole).

T_m = Absolute average dry gas meter temperature (see Figure 5-2), °K (°R).

T_s = Absolute average stack gas temperature (see Figure 5-2), °K (°R).

T_{std} = Standard absolute temperature, 293° K (528° R).

V_a = Volume of acetone blank, ml.

V_{aw} = Volume of acetone used in wash, ml.

V_{lc} = Total volume of liquid collected in impingers and silica gel (see Figure 5-3), ml.

V_m = Volume of gas sample as measured by dry gas meter, dcm (dcf).

$V_{m(std)}$ = Volume of gas sample measured by the dry gas meter, corrected to standard conditions, dscm (dscf).

$V_{w(std)}$ = Volume of water vapor in the gas sample, corrected to standard conditions, scm (scf).

v_s = Stack gas velocity, calculated by Method 2 Equation 2-9, using data obtained from Method 5, m/sec (ft/sec).

W_a = Weight of residue in acetone wash, mg.

Y = Dry gas meter calibration factor.

ΔH = Average pressure differential across the orifice meter (see Figure 5-2), mm H_2O (in. H_2O).

ρ_a = Density of acetone, mg/ml (see label on bottle).

ρ_w = Density of water, 0.9982 g/ml (0.002201 lb/ml).

θ = Total sampling time, min.

θ_1 = Sampling time interval, from the beginning of a run until the first component change, min.

θ_i = Sampling time interval, between two successive component changes, beginning with the interval between the first and second changes, min.

θ_p = Sampling time interval, from the final (n^{th}) component change until the end of the sampling run, min.

13.6 = Specific gravity of mercury.

60 = Sec/min.

100 = Conversion to percent.

6.2 Average dry gas meter temperature and average orifice pressure drop. See data sheet (Figure 5-2).

6.3 Dry Gas Volume. Correct the sample volume measured by the dry gas meter to standard conditions (20° C, 760 mm Hg or 68° F, 29.92 in. Hg) by using Equation 5-1.

$$V_{m(std)} = V_m Y \left(\frac{T_{std}}{T_m}\right)\left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{P_{std}}\right]$$

$$= K_1 V_m Y \frac{P_{bar} + (\Delta H/13.6)}{T_m}$$

Equation 5-1

6.4 Volume of water vapor.

Equation 5-2

$$V_{w(std)} = V_{lc}\left(\frac{\rho_w}{M_w}\right)\left(\frac{R T_{std}}{P_{std}}\right) = K_2 V_{lc}$$

where:

K_2 = 0.001333 m³/ml for metric units
= 0.04707 ft³/ml for English units.

6.5 Moisture Content.

$$B_{ws} = \frac{V_{w(std)}}{V_{m(std)} + V_{w(std)}}$$

where;

K_1 = 0.3858 °K/mm Hg for metric units
= 17.64 °R/in. Hg for English units

NOTE.—Equation 5-1 can be used as written unless the leakage rate observed during any of the mandatory leak checks (i.e., the post-test leak check or leak checks conducted prior to component changes) exceeds L_a. If L_p or L_i exceeds L_a, Equation 5-1 must be modified as follows;

(a) Case I. No component changes made during sampling run. In this case, replace V_m in Equation 5-1 with the expression;

$$V_m - (L_p - L_a)\theta]$$

(b) Case II. One or more component changes made during the sampling run. In this case, replace V_m in Equation 5-1 by the expression:

$$\left[V_m - (L_1 - L_a)\theta_1 - \sum_{i=2}^{n} (L_i - L_a)\theta_i - (L_p - L_a)\theta_p\right]$$

and substitute only for those leakage rates (L_i or L_p) which exceed L_a.

Equation 5-3

$$I=\frac{100\,T_s[K_3V_{1c}+(V_m/T_m)\,(P_{bar}+\Delta H/13.6)]}{60\,\theta v_s P_s A_n}$$

Equation 5-7

where:

K_3=0.003454 mm Hg−m³/ml−°K for metric units.
=0.002669 in. Hg−ft³/ml−°R for English units.

6.11.2 Calculation From Intermediate Values.

$$I=\frac{T_sV_{m\,(std)}\,P_{std}\,100}{T_{std}v_s\theta A_nP_s\,60(1-B_{ws})}$$

$$=K_4\,\frac{T_sV_{m\,(std)}}{P_sV_sA_n\theta(1-B_{ws})}$$

NOTE.—In saturated or water droplet-laden gas streams, two calculations of the moisture content of the stack gas shall be made, one from the impinger analysis (Equation 5-3), and a second from the assumption of saturated conditions. The lower of the two values of B_{ws} shall be considered correct. The procedure for determining the moisture content based upon assumption of saturated conditions is given in the Note of Section 1.2 of Method 4. For the purposes of this method, the average stack gas temperature from Figure 5-2 may be used to make this determination, provided that the accuracy of the in-stack temperature sensor is ± 1° C (2° F).

6.6 Acetone Blank Concentration.

$$C_a=\frac{m_a}{V_a\rho_a}$$

Equation 5-4

6.7 Acetone Wash Blank.

$$W_a=C_aV_{aw}\,\rho_a$$

Equation 5-5

6.8 Total Particulate Weight. Determine the total particulate catch from the sum of the weights obtained from containers 1 and 2 less the acetone blank (see Figure 5-6). NOTE.—Refer to Section 4.1.5 to assist in calculation of results involving two or more filter assemblies or two or more sampling trains.

6.9 Particulate Concentration.

$$c_s=(0.001\ g/mg)\ (m_n/V_{m\,(std)})$$

Equation 5-6

6.10 Conversion Factors:

From	To	Multiply by
scf	m³	0.02832
g/ft³	gr/ft³	15.43
g/ft³	lb/ft³	2.205×10⁻³
g/ft³	g/m³	35.31

6.11 Isokinetic Variation.

6.11.1 Calculation From Raw Data.

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Equation 5-8

where:

K_4=4.320 for metric units
=0.09450 for English units.

6.12 Acceptable Results. If 90 percent ≤ I ≤ 110 percent, the results are acceptable. If the results are low in comparison to the standard and I is beyond the acceptable range, or, if I is less than 90 percent, the Administrator may opt to accept the results. Use Citation 4 to make judgments. Otherwise, reject the results and repeat the test.

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METHOD 6—DETERMINATION OF SULFUR DIOXIDE EMISSIONS FROM STATIONARY SOURCES

1. *Principle and Applicability*

1.1 Principle. A gas sample is extracted from the sampling point in the stack. The sulfuric acid mist (including sulfur trioxide) and the sulfur dioxide are separated. The sulfur dioxide fraction is measured by the barium-thorin titration method.

1.2 Applicability. This method is applicable for the determination of sulfur dioxide emissions from stationary sources. The minimum detectable limit of the method has been determined to be 3.4 milligrams (mg) of SO_2/m^3 (2.12×10^{-7} lb/ft^3). Although no upper limit has been established, tests have shown that concentrations as high as 80,000 mg/m^3 of SO_2 can be collected efficiently in two midget impingers, each containing 15 milliliters of 3 percent hydrogen peroxide, at a rate of 1.0 lpm for 20 minutes. Based on theoretical calculations, the upper concentration limit in a 20-liter sample is about 93,300 mg/m^3.

Possible interferents are free ammonia, water-soluble cations, and fluorides. The cations and fluorides are removed by glass wool filters and an isopropanol bubbler, and hence do not affect the SO_2 analysis. When samples are being taken from a gas stream with high concentrations of very fine metallic fumes (such as in inlets to control devices), a high-efficiency glass fiber filter must be used in place of the glass wool plug (i.e., the one in the probe) to remove the cation interferents.

Free ammonia interferes by reacting with SO_2 to form particulate sulfite and by reacting with the indicator. If free ammonia is present (this can be determined by knowledge of the process and noticing white particulate matter in the probe and isopropanol bubbler), alternative methods, subject to the approval of the Administrator, U.S. Environmental Protection Agency, are required.

2. *Apparatus*

2.1 Sampling. The sampling train is shown in Figure 6-1, and component parts are discussed below. The tester has the option of substituting sampling equipment described in Method 8 in place of the midget impinger equipment of Method 6. However, the Method 8 train must be modified to include a heated filter between the probe and isopropanol impinger, and the operation of the sampling train and sample analysis must be at the flow rates and solution volumes defined in Method 8.

The tester also has the option of determining SO_2 simultaneously with particulate matter and moisture determinations by (1) replacing the water in a Method 5 impinger system with 3 percent perioxide solution, or (2) by replacing the Method 5 water impinger system with a Method 8 isopropanol-filter-peroxide system. The analysis for SO_2 must be consistent with the procedure in Method 8.

2.1.1 Probe. Borosilicate glass, or stainless steel (other materials of construction may be used, subject to the approval of the Administrator), approximately 6-mm inside diameter, with a heating system to prevent water condensation and a filter (either in-stack or heated out-stack) to remove particulate matter, including sulfuric acid mist. A plug of glass wool is a satisfactory filter.

2.1.2 Bubbler and Impingers. One midget bubbler, with medium-coarse glass frit and borosilicate or quartz glass wool packed in top (see Figure 6-1) to prevent sulfuric acid mist carryover, and three 30-ml midget impingers. The bubbler and midget impingers must be connected in series with leak-free glass connectors. Silicone grease may be used, if necessary, to prevent leakage.

At the option of the tester, a midget impinger may be used in place of the midget bubbler.

Other collection absorbers and flow rates may be used, but are subject to the approval of the Administrator. Also, collection efficiency must be shown to be at least 99 percent for each test run and must be documented in the report. If the efficiency is found to be acceptable after a series of three tests, further documentation is not required. To conduct the efficiency test, an extra absorber must be added and analyzed separately. This extra absorber must not contain more than 1 percent of the total SO_2.

2.1.3 Glass Wool. Borosilicate or quartz.

2.1.4 Stopcock Grease. Acetone-insoluble, heat-stable silicone grease may be used, if necessary.

2.1.5 Temperature Gauge. Dial thermometer, or equivalent, to measure temperature of gas leaving impinger train to within 1° C (2° F.)

2.1.6 Drying Tube. Tube packed with 6- to 16-mesh indicating type silica gel, or equivalent, to dry the gas sample and to protect the meter and pump. If the silica gel has been used previously, dry at 175° C (350° F) for 2 hours. New silica gel may be used as received. Alternatively, other types of desiccants (equivalent or better) may be used, subject to approval of the Administrator.

2.1.7 Valve. Needle valve, to regulate sample gas flow rate.

2.1.8 Pump. Leak-free diaphragm pump, or equivalent, to pull gas through the train. Install a small tank between the pump and rate meter to eliminate the pulsation effect of the diaphragm pump on the rotameter.

2.1.9 Rate Meter. Rotameter, or equivalent, capable of measuring flow rate to within 2 percent of the selected flow rate of about 1000 cc/min.

2.1.10 Volume Meter. Dry gas meter, sufficiently accurate to measure the sample volume within 2 percent, calibrated at the selected flow rate and conditions actually encountered during sampling, and equipped with a temperature gauge (dial thermometer, or equivalent) capable of measuring temperature to within 3° C (5.4° F).

2.1.11 Barometer. Mercury, aneroid, or other barometer capable of measuring atmospheric pressure to within 2.5 mm Hg (0.1 in. Hg). In many cases, the barometric reading may be obtained from a nearby national weather service station, in which case the station value (which is the absolute barometric pressure) shall be requested and an adjustment for elevation differences between the weather station and sampling point shall be applied at a rate of minus 2.5 mm Hg (0.1 in. Hg) per 30 m (100 ft) elevation increase or vice versa for elevation decrease.

2.1.12 Vacuum Gauge. At least 760 mm Hg (30 in. Hg) gauge, to be used for leak check of the sampling train.

2.2 Sample Recovery.

2.2.1 Wash bottles. Polyethylene or glass, 500 ml, two.

2.2.2 Storage Bottles. Polyethylene, 100 ml, to store impinger samples (one per sample).

2.3 Analysis.

2.3.1 Pipettes. Volumetric type, 5-ml, 20-ml (one per sample), and 25-ml sizes.

2.3.2 Volumetric Flasks. 100-ml size (one per sample) and 1000-ml size.

2.3.3 Burettes. 5- and 50-ml sizes.

2.3.4 Erlenmeyer Flasks. 250 ml-size (one for each sample, blank, and standard).

2.3.5 Dropping Bottle. 125-ml size, to add indicator.

2.3.6 Graduated Cylinder. 100-ml size.

2.3.7 Spectrophotometer. To measure absorbance at 352 nanometers.

3. *Reagents*

Unless otherwise indicated, all reagents must conform to the specifications established by the Committee on Analytical Reagents of the American Chemical Society. Where such specifications are not available, use the best available grade.

3.1 Sampling.

3.1.1 Water. Deionized, distilled to conform to ASTM specification D1193-74, Type 3. At the option of the analyst, the $KMnO_4$ test for oxidizable organic matter may be omitted when high concentrations of organic matter are not expected to be present.

3.1.2 Isopropanol, 80 percent. Mix 80 ml of isopropanol with 20 ml of deionized, distilled water. Check each lot of isopropanol for peroxide impurities as follows: shake 10 ml of isopropanol with 10 ml of freshly prepared 10 percent potassium iodide solution. Prepare a blank by similarly treating 10 ml of distilled water. After 1 minute, read the absorbance at 352 nanometers on a spectrophotometer. If absorbance exceeds 0.1, reject alcohol for use.

Peroxides may be removed from isopropanol by redistilling or by passage through a column of activated alumina; however, reagent grade isopropanol with suitably low peroxide levels may be obtained from commercial sources. Rejection of contaminated lots may, therefore, be a more efficient procedure.

3.1.3 Hydrogen Peroxide, 3 Percent. Dilute 30 percent hydrogen peroxide 1:9 (v/v) with deionized, distilled water (30 ml is needed per sample). Prepare fresh daily.

3.1.4 Potassium Iodide Solution, 10 Percent. Dissolve 10.0 grams KI in deionized, distilled water and dilute to 100 ml. Prepare when needed.

3.2 Sample Recovery.

3.2.1 Water. Deionized, distilled, as in 3.1.1.

3.2.2 Isopropanol, 80 Percent. Mix 80 ml of isopropanol with 20 ml of deionized, distilled water.

3.3 Analysis.

3.3.1 Water. Deionized, distilled, as in 3.1.1.

3.3.2 Isopropanol, 100 percent.

3.3.3 Thorin Indicator. 1-(o-arsonophenylazo)-2-naphthol-3,6-disulfonic acid, disodium salt, or equivalent. Dissolve 0.20 g in 100 ml of deionized, distilled water.

3.3.4 Barium Perchlorate Solution, 0.0100 N. Dissolve 1.95 g of barium perchlorate trihydrate [$Ba(ClO_4)_2 \cdot 3H_2O$] in 200 ml distilled water and dilute to 1 liter with isopropanol. Alternatively, 1.22 g of [$BaCl_2 \cdot 2H_2O$] may be used instead of the perchlorate. Standardize as in Section 5.5.

3.3.5 Sulfuric Acid Standard, 0.0100 N. Purchase or standardize to ±0.0002 N against 0.0100 N NaOH which has previously been standardized against potassium acid phthalate (primary standard grade).

4. *Procedure.*

4.1 Sampling

4.1.1 Preparation of collection train. Measure 15 ml of 80 percent isopropanol into the midget bubbler and 15 ml of 3 percent hydrogen peroxide into each of the first two midget impingers. Leave the final midget impinger dry. Assemble the train as shown in Figure 6-1. Adjust probe heater to a temperature sufficient to prevent water condensation. Place crushed ice and water around the impingers.

4.1.2 Leak-check procedure. A leak check prior to the sampling run is optional; however, a leak check after the sampling run is mandatory. The leak-check procedure is as follows:

With the probe disconnected, place a vacuum gauge at the inlet to the bubbler and pull a vacuum of 250 mm (10 in.) Hg; plug or pinch off the outlet of the flow meter, and then turn off the pump. The vacuum shall remain stable for at least 30 seconds. Carefully release the vacuum gauge before releasing the flow meter end to prevent back flow of the impinger fluid.

Other leak-check procedures may be used, subject to the approval of the Administrator, U.S. Environmental Protection Agency. The procedure used in Method 5 is not suitable for diaphragm pumps.

4.1.3 Sample collection. Record the initial dry gas meter reading and barometric pressure. To begin sampling, position the tip of the probe at the sampling point, connect the probe to the bubbler, and start the pump. Adjust the sample flow to a constant rate of approximately 1.0 liter/min as indicated by the rotameter. Maintain this constant rate (±10 percent) during the entire sampling run. Take readings (dry gas meter, temperatures at dry gas meter and at impinger outlet and rate meter) at least every 5 minutes. Add more ice during the run to keep the temperature of the gases leaving the last impinger at 20° C (68° F) or less. At the conclusion of each run, turn off the pump, remove probe from the stack, and record the final readings. Conduct a leak check as in Section 4.1.2. (This leak check is mandatory.) If a leak is found, void the test run. Drain the ice bath, and purge the remaining part of the train by drawing clean ambient air through the system for 15 minutes at the sampling rate.

Clean ambient air can be provided by passing air through a charcoal filter or through an extra midget impinger with 15 ml of 3 percent H_2O_2. The tester may opt to simply use ambient air, without purification.

4.2 Sample Recovery. Disconnect the impingers after purging. Discard the contents of the midget bubbler. Pour the contents of the midget impingers into a leak-free polyethylene bottle for shipment. Rinse the three midget impingers and the connecting tubes with deionized, distilled water, and add the washings to the same storage container. Mark the fluid level. Seal and identify the sample container.

4.3 Sample Analysis. Note level of liquid in container, and confirm whether any sample was lost during shipment; note this on analytical data sheet. If a noticeable amount of leakage has occurred, either void the sample or use methods, subject to the approval of the Administrator, to correct the final results.

Transfer the contents of the storage container to a 100-ml volumetric flask and dilute to exactly 100 ml with deionized, distilled water. Pipette a 20-ml aliquot of this solution into a 250-ml Erlenmeyer flask, add 80 ml of 100 percent isopropanol and two to four drops of thorin indicator, and titrate to a pink endpoint using 0.0100 N barium perchlorate. Repeat and average the titration volumes. Run a blank with each series of samples. Replicate titrations must agree within 1 percent or 0.2 ml, whichever is larger.

(NOTE.—Protect the 0.0100 *N* barium perchlorate solution from evaporation at all times.)

5. *Calibration*

5.1 Metering System.

5.1.1 Initial Calibration. Before its initial use in the field, first leak check the metering system (drying tube, needle valve, pump, rotameter, and dry gas meter) as follows: place a vacuum gauge at the inlet to the drying tube and pull a vacuum of 250 mm (10 in.) Hg; plug or pinch off the outlet or the flow meter, and then turn off the pump. The vacuum shall remain stable for at least 30 seconds. Carefully release the vacuum gauge before releasing the flow meter end.

Next, calibrate the metering system (at the sampling flow rate specified by the method) as follows: connect an appropriately sized wet test meter (e.g., 1 liter per revolution) to the inlet of the drying tube. Make three independent calibration runs, using at least five revolutions of the dry gas meter per run. Calculate the calibration factor, *Y* (wet test meter calibration volume divided by the dry gas meter volume, both volumes adjusted to the same reference temperature and pressure), for each run, and average the results. If any *Y* value deviates by more than 2 percent from the average, the metering system is unacceptable for use. Otherwise, use the average as the calibration factor for subsequent test runs.

5.1.2 Post-Test Calibration Check. After each field test series, conduct a calibration check as in Section 5.1.1 above, except for the following variations: (a) the leak check is not to be conducted, (b) three, or more revolutions of the dry gas meter may be used, and (c) only two independent runs need be made. If the calibration factor does not deviate by more than 5 percent from the initial calibration factor (determined in Section 5.1.1), then the dry gas meter volumes obtained during the test series are acceptable. If the calibration factor deviates by more than 5 percent, recalibrate the metering system as in Section 5.1.1, and for the calculations, use the calibration factor (initial or recalibration) that yields the lower gas volume for each test run.

5.2 Thermometers. Calibrate against mercury-in-glass thermometers.

5.3 Rotameter. The rotameter need not be calibrated but should be cleaned and maintained according to the manufacturer's instruction.

5.4 Barometer. Calibrate against a mercury barometer.

5.5 Barium Perchlorate Solution. Standardize the barium perchlorate solution against 25 ml of standard sulfuric acid to which 100 ml of 100 percent isopropanol has been added.

6. Calculations

Carry out calculations, retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after final calculation.

6.1 Nomenclature.

C_{SO_2} = Concentration of sulfur dioxide, dry basis corrected to standard conditions, mg/dscm (lb/dscf).
N = Normality of barium perchlorate titrant, milliequivalents/ml.
P_{bar} = Barometric pressure at the exit orifice of the dry gas meter, mm Hg (in. Hg).
P_{std} = Standard absolute pressure, 760 mm Hg (29.92 in. Hg).
T_m = Average dry gas meter absolute temperature, °K (°R).
T_{std} = Standard absolute temperature, 293° K (528° R).
V_a = Volume of sample aliquot titrated, ml.
V_m = Dry gas volume as measured by the dry gas meter, dcm (dcf).
$V_{m(std)}$ = Dry gas volume measured by the dry gas meter, corrected to standard conditions, dscm (dscf).
V_{soln} = Total volume of solution in which the sulfur dioxide sample is contained, 100 ml.
V_t = Volume of barium perchlorate titrant used for the sample, ml (average of replicate titrations).
V_{tb} = Volume of barium perchlorate titrant used for the blank, ml.
Y = Dry gas meter calibration factor.
32.03 = Equivalent weight of sulfur dioxide.

6.2 Dry sample gas volume, corrected to standard conditions.

$$V_{m(std)} = V_m Y \left(\frac{T_{std}}{T_m}\right)\left(\frac{P_{bar}}{P_{std}}\right) = K_1 Y \frac{V_m P_{bar}}{T_m}$$

Equation 6-1

where:

K_1 = 0.3858 °K/mm Hg for metric units.
= 17.64 °R/in. Hg for English units.

6.3 Sulfur dioxide concentration.

$$C_{SO_2} = K_2 \frac{(V_t - V_{tb})\, N \left(\frac{V_{soln}}{V_a}\right)}{V_{m(std)}}$$

Equation 6-2

where:

K_2 = 32.03 mg/meq. for metric units.
= 7.061×10^{-5} lb/meq. for English units.

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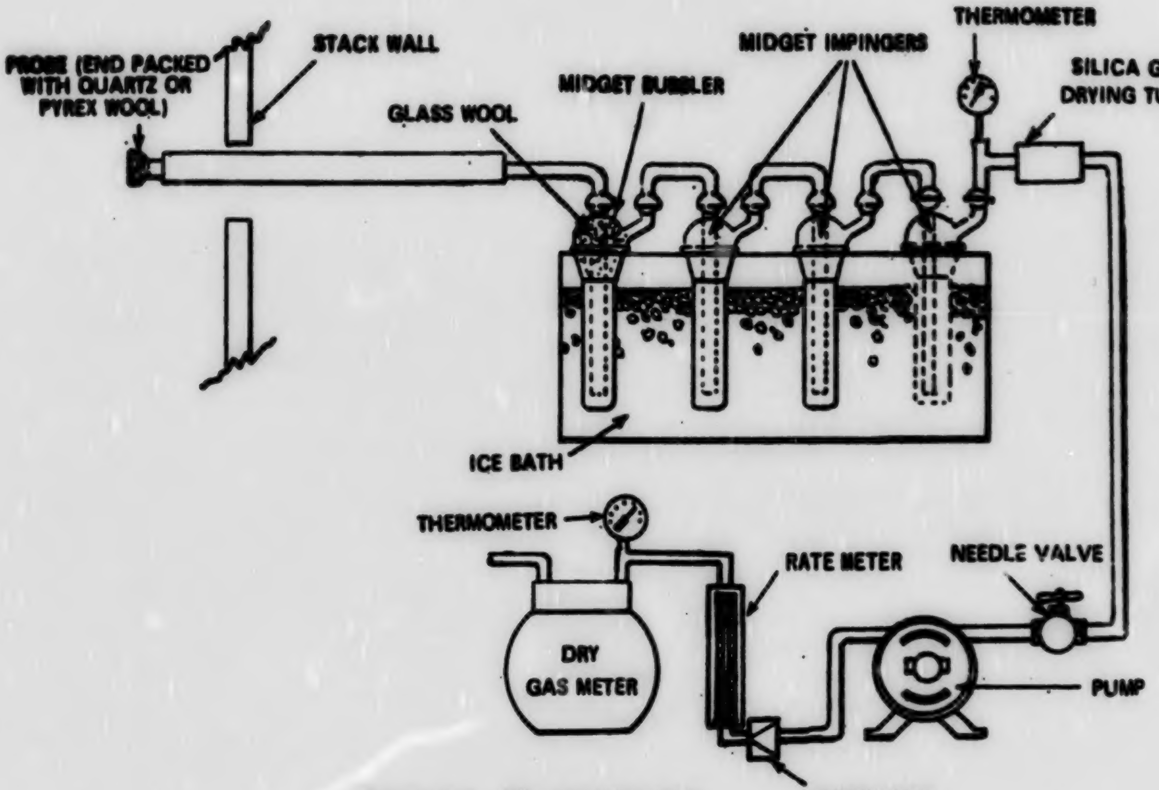

Figure 6-1. SO_2 sampling train.

METHOD 7—DETERMINATION OF NITROGEN OXIDE EMISSIONS FROM STATIONARY SOURCES

1. *Principle and Applicability*

1.1 Principle. A grab sample is collected in an evacuated flask containing a dilute sulfuric acid-hydrogen peroxide absorbing solution, and the nitrogen oxides, except nitrous oxide, are measured colorimetrically using the phenoldisulfonic acid (PDS) procedure.

1.2 Applicability. This method is applicable to the measurement of nitrogen oxides emitted from stationary sources. The range of the method has been determined to be 2 to 400 milligrams NO_x (as NO_2) per dry standard cubic meter, without having to dilute the sample.

2. *Apparatus*

2.1 Sampling (see Figure 7-1). Other grab sampling systems or equipment, capable of measuring sample volume to within ±2.0 percent and collecting a sufficient sample volume to allow analytical reproducibility to within ±5 percent, will be considered acceptable alternatives, subject to approval of the Administrator, U.S. Environmental Protection Agency. The following equipment is used in sampling:

2.1.1 Probe. Borosilicate glass tubing, sufficiently heated to prevent water condensation and equipped with an in-stack or out-stack filter to remove particulate matter (a plug of glass wool is satisfactory for this purpose). Stainless steel or Teflon[1] tubing may also be used for the probe. Heating is not necessary if the probe remains dry during the purging period.

2.1.2 Collection Flask. Two-liter borosilicate, round bottom flask, with short neck and 24/40 standard taper opening, protected against implosion or breakage.

2.1.3 Flask Valve. T-bore stopcock connected to a 24/40 standard taper joint.

2.1.4 Temperature Gauge. Dial-type thermometer, or other temperature gauge, capable of measuring 1° C (2° F) intervals from −5 to 50° C (25 to 125° F).

2.1.5 Vacuum Line. Tubing capable of withstanding a vacuum of 75 mm Hg (3 in. Hg) absolute pressure, with "T" connection and T-bore stopcock.

2.1.6 Vacuum Gauge. U-tube manometer, 1 meter (36 in.), with 1-mm (0.1-in.) divisions, or other gauge capable of measuring pressure to within ±2.5 mm Hg (0.10 in. Hg).

2.1.7 Pump. Capable of evacuating the collection flask to a pressure equal to or less than 75 mm Hg (3 in. Hg) absolute.

2.1.8 Squeeze Bulb. One-way.

2.1.9 Volumetric Pipette. 25 ml.

2.1.10 Stopcock and Ground Joint Grease. A high-vacuum, high-temperature chlorofluorocarbon grease is required. Halocarbon 25-5S has been found to be effective.

2.1.11 Barometer. Mercury, aneroid, or other barometer capable of measuring atmospheric pressure to within 2.5 mm Hg (0.1 in. Hg). In many cases, the barometric reading may be obtained from a nearby national weather service station, in which case the station value (which is the absolute barometric pressure) shall be requested and an adjustment for elevation differences between the weather station and sampling point shall be applied at a rate of minus 2.5 mm Hg (0.1 in. Hg) per 30 m (100 ft) elevation increase, or vice versa for elevation decrease.

2.2 Sample Recovery. The following equipment is required for sample recovery:

2.2.1 Graduated Cylinder. 50 ml with 1-ml divisions.

2.2.2 Storage Containers. Leak-free polyethylene bottles.

2.2.3 Wash Bottle. Polyethylene or glass.

2.2.4 Glass Stirring Rod.

2.2.5 Test Paper for Indicating pH. To cover the pH range of 7 to 14.

2.3 Analysis. For the analysis, the following equipment is needed:

2.3.1 Volumetric Pipettes. Two 1 ml, two 2 ml, one 3 ml, one 4 ml, two 10 ml, and one 25 ml for each sample and standard.

2.3.2 Porcelain Evaporating Dishes. 175- to 250-ml capacity with lip for pouring, one for each sample and each standard. The Coors No. 45006 (shallow-form, 195 ml) has been found to be satisfactory. Alternatively, polymethyl pentene beakers (Nalge No. 1203, 150 ml), or glass beakers (150 ml) may be used. When glass beakers are used, etching of the beakers may cause solid matter to be present in the analytical step: the solids should be removed by filtration (see Section 4.3).

2.3.3 Steam Bath. Low-temperature ovens or thermostatically controlled hot plates kept below 70° C (160° F) are acceptable alternatives.

2.3.4 Dropping Pipette or Dropper. Three required.

2.3.5 Polyethylene Policeman. One for each sample and each standard.

2.3.6 Graduated Cylinder. 100 ml with 1-ml divisions.

2.3.7 Volumetric Flasks. 50 ml (one for each sample), 100 ml (one for each sample and each standard, and one for the working standard KNO_3 solution), and 1000 ml (one).

2.3.8 Spectrophotometer. To measure absorbance at 410 nm.

2.3.9 Graduated Pipette. 10 ml with 0.1-ml divisions.

2.3.10 Test Paper for Indicating pH. To cover the pH range of 7 to 14.

2.3.11 Analytical Balance. To measure to within 0.1 mg.

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[1] Mention of trade names or specific products does not constitute endorsement by the Environmental Protection Agency.

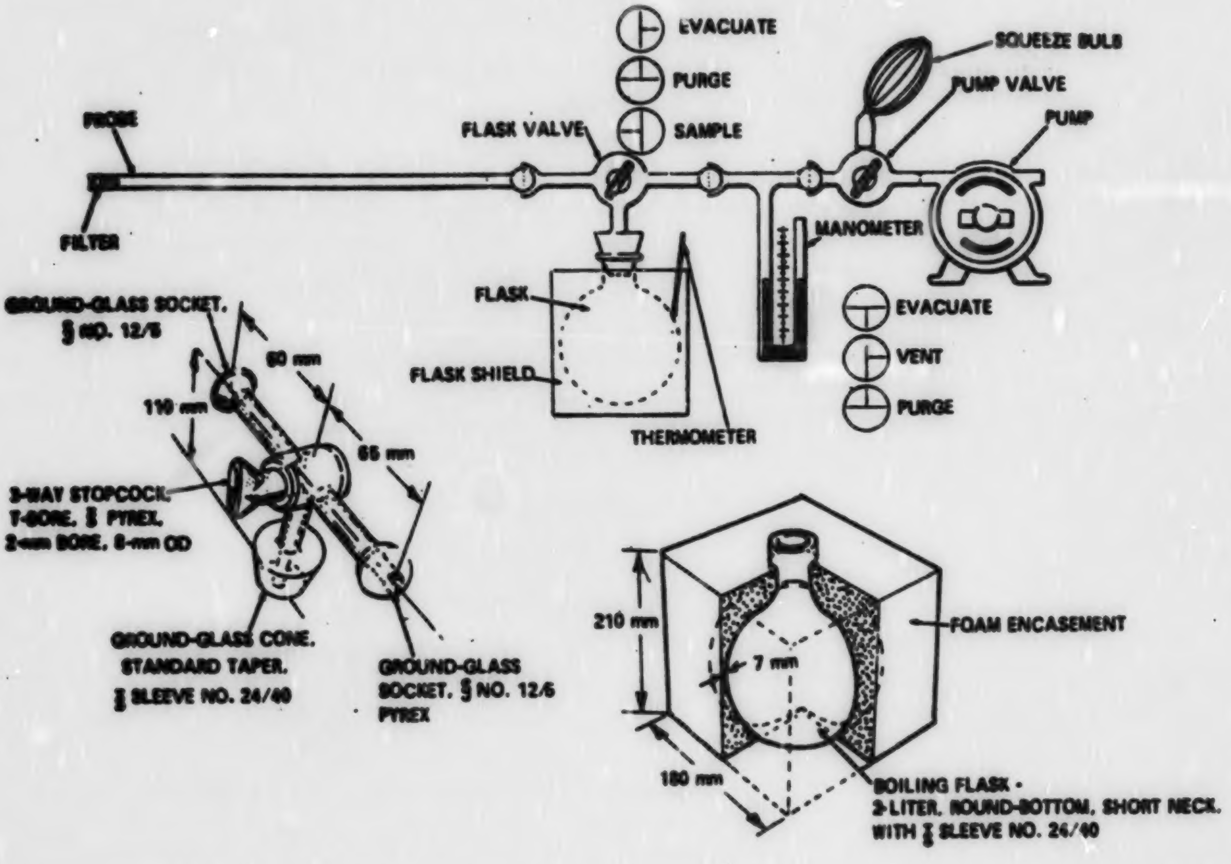
EVACUATE
PURGE
SAMPLE
SQUEEZE BULB
PUMP VALVE
PUMP
PROBE
FLASK VALVE
FILTER
MANOMETER
FLASK
FLASK SHIELD
THERMOMETER
EVACUATE
VENT
PURGE
GROUND-GLASS SOCKET, § NO. 12/5
80 mm
110 mm
65 mm
3-WAY STOPCOCK, T-BORE, § PYREX, 2-mm BORE, 8-mm OD
GROUND-GLASS CONE, STANDARD TAPER, § SLEEVE NO. 24/40
GROUND-GLASS SOCKET, § NO. 12/5 PYREX
210 mm
FOAM ENCASEMENT
7 mm
180 mm
BOILING FLASK - 2-LITER, ROUND-BOTTOM, SHORT NECK, WITH § SLEEVE NO. 24/40

Figure 7-1. Sampling train, flask valve, and flask.

3. *Reagents*

Unless otherwise indicated, it is intended that all reagents conform to the specifications established by the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available; otherwise, use the best available grade.

3.1 Sampling. To prepare the absorbing solution, cautiously add 2.8 ml concentrated H_2SO_4 to 1 liter of deionized, distilled water. Mix well and add 6 ml of 3 percent hydrogen peroxide, freshly prepared from 30 percent hydrogen peroxide solution. The absorbing solution should be used within 1 week of its preparation. Do not expose to extreme heat or direct sunlight.

3.2 Sample Recovery. Two reagents are required for sample recovery:

3.2.1 Sodium Hydroxide (1N). Dissolve 40 g NaOH in deionized, distilled water and dilute to 1 liter.

3.2.2 Water. Deionized, distilled to conform to ASTM specification D1193-74, Type 3. At the option of the analyst, the $KMnO_4$ test for oxidizable organic matter may be omitted when high concentrations of organic matter are not expected to be present.

3.3 Analysis. For the analysis, the following reagents are required:

3.3.1 Fuming Sulfuric Acid. 15 to 18 percent by weight free sulfur trioxide. HANDLE WITH CAUTION.

3.3.2 Phenol. White solid.

3.3.3 Sulfuric Acid. Concentrated, 95 percent minimum assay. HANDLE WITH CAUTION.

3.3.4 Potassium Nitrate. Dried at 105 to 110° C (221 to 230° F) for a minimum of 2 hours just prior to preparation of standard solution.

3.3.5 Standard KNO_3 Solution. Dissolve exactly 2.198 g of dried potassium nitrate (KNO_3) in deionized, distilled water and dilute to 1 liter with deionized, distilled water in a 1,000-ml volumetric flask.

3.3.6 Working Standard KNO_3 Solution. Dilute 10 ml of the standard solution to 100 ml with deionized distilled water. One milliliter of the working standard solution is equivalent to 100 μg nitrogen dioxide (NO_2).

3.3.7 Water. Deionized, distilled as in Section 3.2.2.

3.3.8 Phenoldisulfonic Acid Solution. Dissolve 25 g of pure white phenol in 150 ml concentrated sulfuric acid on a steam bath. Cool, add 75 ml fuming sulfuric acid, and heat at 100° C (212° F) for 2 hours. Store in a dark, stoppered bottle.

4. *Procedure*

4.1 Sampling.

4.1.1 Pipette 25 ml of absorbing solution into a sample flask, retaining a sufficient quantity for use in preparing the calibration standards. Insert the flask valve stopper into the flask with the valve in the "purge" position. Assemble the sampling train as shown in Figure 7-1 and place the probe at the sampling point. Make sure that all fittings are tight and leak-free, and that all ground glass joints have been properly greased with a high-vacuum, high-temperature chlorofluorocarbon-based stopcock grease. Turn the flask valve and the pump valve to their "evacuate" positions. Evacuate the flask to 75 mm Hg (3 in. Hg) absolute pressure, or less. Evacuation to a pressure approaching the vapor pressure of water at the existing temperature is desirable. Turn the pump valve to its "vent" position and turn off the pump. Check for leakage by observing the manometer for any pressure fluctuation. (Any variation greater than 10 mm Hg (0.4 in. Hg) over a period of 1 minute is not acceptable, and the flask is not to be used until the leakage problem is corrected. Pressure in the flask is not to exceed 75 mm Hg (3 in. Hg) absolute at the time sampling is commenced.) Record the volume of the flask and valve (V_f), the flask temperature (T_i), and the barometric pressure. Turn the flask valve counterclockwise to its "purge" position and do the same with the pump valve. Purge the probe and the vacuum tube using the squeeze bulb. If condensation occurs in the probe and the flask valve area, heat the probe and purge until the condensation disappears. Next, turn the pump valve to its "vent" position. Turn the flask valve clockwise to its "evacuate" position and record the difference in the mercury levels in the manometer. The absolute internal pressure in the flask (P_i) is equal to the barometric pressure less the manometer reading. Immediately turn the flask valve to the "sample" position and permit the gas to enter the flask until pressures in the flask and sample line (i.e., duct, stack) are equal. This will usually require about 15 seconds; a longer period indicates a "plug" in the probe, which must be corrected before sampling is continued. After collecting the sample, turn the flask valve to its "purge" position and disconnect the flask from the sampling train. Shake the flask for at least 5 minutes.

4.1.2 If the gas being sampled contains insufficient oxygen for the conversion of NO to NO_2 (e.g., an applicable subpart of the standard may require taking a sample of a calibration gas mixture of NO in N_2), then oxygen shall be introduced into the flask to permit this conversion. Oxygen may be introduced into the flask by one of three methods; (1) Before evacuating the sampling flask, flush with pure cylinder oxygen, then evacuate flask to 75 mm Hg (3 in. Hg) absolute pressure or less; or (2) inject oxygen into the flask after sampling; or (3) terminate sampling with a minimum of 50 mm Hg (2 in. Hg) vacuum remaining in the flask, record this final pressure, and then vent the flask to the atmosphere until the flask pressure is almost equal to atmospheric pressure.

4.2 Sample Recovery. Let the flask set for a minimum of 16 hours and then shake the contents for 2 minutes. Connect the flask to a mercury filled U-tube manometer. Open the valve from the flask to the manometer and record the flask temperature (T_f), the barometric pressure, and the difference between the mercury levels in the manometer. The absolute internal pressure in the flask (P_f) is the barometric pressure less the manometer reading. Transfer the contents of the flask to a leak-free polyethylene bottle. Rinse the flask twice with 5-ml portions of deionized, distilled water and add the rinse water to the bottle. Adjust the pH to between 9 and 12 by adding sodium hydroxide (1 N), dropwise (about 25 to 35 drops). Check the pH by dipping a stirring rod into the solution and then touching the rod to the pH test paper. Remove as little material as possible during this step. Mark the height of the liquid level so that the container can be checked for leakage after transport. Label the container to clearly identify its contents. Seal the container for shipping.

4.3 Analysis. Note the level of the liquid in container and confirm whether or not any sample was lost during shipment; note this on the analytical data sheet. If a noticeable amount of leakage has occurred, either void the sample or use methods, subject to the approval of the Administrator, to correct the final results. Immediately prior to analysis, transfer the contents of the shipping container to a 50-ml volumetric flask, and rinse the container twice with 5-ml portions of deionized, distilled water. Add the rinse water to the flask and dilute to the mark with deionized, distilled water; mix thoroughly. Pipette a 25-ml aliquot into the procelain evaporating dish. Return any unused portion of the sample to the polyethylene storage bottle. Evaporate the 25-ml aliquot to dryness on a steam bath and allow to cool. Add 2 ml phenoldisulfonic acid solution to the dried residue and triturate thoroughly with a poylethylene policeman. Make sure the solution contacts all the residue. Add 1 ml deionized, distilled water and four drops of concentrated sulfuric acid. Heat the solution on a steam bath for 3 minutes with occasional stirring. Allow the solution to cool, add 20 ml deionized, distilled water, mix well by stirring, and add concentrated ammonium hydroxide, dropwise, with constant stirring, until the pH is 10 (as determined by pH paper). If the sample contains solids, these must be removed by filtration (centrifugation is an acceptable alternative, subject to the approval of the Administrator), as follows: filter through Whatman No. 41 filter paper into a 100-ml volumetric flask; rinse the evaporating dish with three 5-ml portions of deionized, distilled water; filter these three rinses. Wash the filter with at least three 15-ml portions of deionized, distilled water. Add the filter washings to the contents of the volumetric flask and dilute to the mark with deionized, distilled water. If solids are absent, the solution can be transferred directly to the 100-ml volumetric flask and diluted to the mark with deionized, distilled water. Mix the contents of the flask thoroughly, and measure the absorbance at the optimum wavelength used for the standards (Section 5.2.1), using the blank solution as a zero reference. Dilute the sample and the blank with equal volumes of deionized, distilled water if the absorbance exceeds A_4, the absorbance of the 400 μg NO_2 standard (see Section 5.2.2).

5. *Calibration*

5.1 *Flask Volume.* The volume of the collection flask-flask valve combination must be known prior to sampling. Assemble the flask and flask valve and fill with water, to the stopcock. Measure the volume of water to ±10 ml. Record this volume on the flask.

5.2 Spectrophotometer Calibration.

5.2.1 Optimum Wavelength Determination. For both fixed and variable wavelength spectrophotometers, calibrate against standard certified wavelength of 410 nm, every 6 months. Alternatively, for variable wavelength spectrophotometers, scan the spectrum between 400 and 415 nm using a 200 μg NO_2 standard solution (see Section 5.2.2). If a peak does not occur, the spectrophotometer is probably malfunctioning, and should be repaired. When a peak is obtained within the 400 to 415 nm range, the wavelength at which this peak occurs shall be the optimum wavelength for the measurement of absorbance for both the standards and samples.

5.2.2 Determination of Spectrophotometer Calibration Factor K_c. Add 0.0, 1.0, 2.0, 3.0, and 4.0 ml of the KNO_3 working standard solution (1 ml=100 μg NO_2) to a series of five porcelain evaporating dishes. To each, add 25 ml of absorbing solution, 10 ml deionized, distilled water, and sodium hydroxide (1N), dropwise, until the pH is between 9 and 12 (about 25 to 35 drops each). Beginning with the evaporation step, follow the analysis procedure of Section 4.3, until the solution has been transferred to the 100 ml volumetric flask and diluted to the mark. Measure the absorbance of each solution, at the optimum wavelength, as determined in Section 5.2.1. This calibration procedure must be repeated on each day that samples are analyzed. Calculate the spectrophotometer calibration factor as follows:

$$K_c = 100\,\frac{A_1 + 2A_2 + 3A_3 + 4A_4}{A_1^2 + A_2^2 + A_3^2 + A_4^2}$$

Equation 7-1

where:

K_c = Calibration factor
A_1 = Absorbance of the 100-μg NO_2 standard
A_2 = Absorbance of the 200-μg NO_2 standard
A_3 = Absorbance of the 300-μg NO_2 standard
A_4 = Absorbance of the 400-μg NO_2 standard

5.3 Barometer. Calibrate against a mercury barometer.

5.4 Temperature Gauge. Calibrate dial thermometers against mercury-in-glass thermometers.

5.5 Vacuum Gauge. Calibrate mechanical gauges, if used, against a mercury manometer such as that specified in 2.1.6.

5.6 Analytical Balance. Calibrate against standard weights.

6. *Calculations*

Carry out the calculations, retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after final calculations.

6.1 Nomenclature.

A = Absorbance of sample.
C = Concentration of NO_x as NO_2, dry basis, corrected to standard conditions, mg/dscm (lb/dscf).
F = Dilution factor (i.e., 25/5, 25/10, etc., required only if sample dilution was needed to reduce the absorbance into the range of calibration).
K_c = Spectrophotometer calibration factor.
m = Mass of NO_x as NO_2 in gas sample, μg.
P_f = Final absolute pressure of flask, mm Hg (in. Hg).
P_i = Initial absolute pressure of flask, mm Hg (in. Hg).
P_{std} = Standard absolute pressure, 760 mm Hg (29.92 in. Hg).
T_f = Final absolute temperature of flask, °K (°R).
T_i = Initial absolute temperature of flask, °K (°R).
T_{std} = Standard absolute temperature, 293° K (528° R)
V_{sc} = Sample volume at standard conditions (dry basis), ml.
V_f = Volume of flask and valve, ml.
V_a = Volume of absorbing solution, 25 ml.
2 = 50/25, the aliquot factor. (If other than a 25-ml aliquot was used for analysis, the corresponding factor must be substituted).

6.2 Sample volume, dry basis, corrected to standard conditions.

$$V_{sc} = \frac{T_{std}}{P_{std}}\,(V_f - V_a)\left[\frac{P_f}{T_f} - \frac{P_i}{T_i}\right]$$

$$= K_1 (V_f - 25\ \text{ml})\left[\frac{P_f}{T_f} - \frac{P_i}{T_i}\right]$$

Equation 7-2

where:

$$K_1 = 0.3858\ \frac{°\text{K}}{\text{mm Hg}}\ \text{for metric units}$$

$$= 17.64\ \frac{°\text{R}}{\text{in. Hg}}\ \text{for English units}$$

6.3 Total μg NO_2 per sample.

$$m = 2\,K_c\,A\,F$$

Equation 7-3

NOTE.—If other than a 25-ml aliquot is used for analysis, the factor 2 must be replaced by a corresponding factor.

6.4 Sample concentration, dry basis, corrected to standard conditions.

$$C = K_2\,\frac{m}{V_{sc}}$$

Equation 7-4

where:

$$K_2 = 10^3\ \frac{\text{mg/m}^3}{\mu\text{g/ml}}\ \text{for metric units}$$

$$= 6.243\times10^{-5}\ \frac{\text{lb/scf}}{\mu\text{g/ml}}\ \text{for English units}$$

7. *Bibliography*

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METHOD 8—DETERMINATION OF SULFURIC ACID MIST AND SULFUR DIOXIDE EMISSIONS FROM STATIONARY SOURCES

1. *Principle and Applicability*

1.1 Principle. A gas sample is extracted isokinetically from the stack. The sulfuric acid mist (including sulfur trioxide) and the sulfur dioxide are separated, and both fractions are measured separately by the barium-thorin titration method.

1.2 Applicability. This method is applicable for the determination of sulfuric acid mist (including sulfur trioxide, and in the absence of other particulate matter) and sulfur dioxide emissions from stationary sources. Collaborative tests have shown that the minimum detectable limits of the method are 0.05 milligrams/cubic meter (0.03×10^{-7} pounds/cubic foot) for sulfur trioxide and 1.2 mg/m³ (0.74×10^{-7} lb/ft³) for sulfur dioxide. No upper limits have been established. Based on theoretical calculations for 200 milliliters of 3 percent hydrogen peroxide solution, the upper concentration limit for sulfur dioxide in a 1.0 m³ (35.3 ft³) gas sample is about 12,500 mg/m³ (7.7×10^{-4} lb/ft³). The upper limit can be extended by increasing the quantity of peroxide solution in the impingers.

Possible interfering agents of this method are fluorides, free ammonia, and dimethyl aniline. If any of these interfering agents are present (this can be determined by knowledge of the process), alternative methods, subject to the approval of the Administrator, are required.

Filterable particulate matter may be determined along with SO_3 and SO_2 (subject to the approval of the Administrator); however, the procedure used for particulate matter must be consistent with the specifications and procedures given in Method 5.

2. *Apparatus*

2.1 Sampling. A schematic of the sampling train used in this method is shown in Figure 8-1; it is similar to the Method 5 train except that the filter position is different and the filter holder does not have to be heated. Commercial models of this train are available. For those who desire to build their own, however, complete construction details are described in APTD-0581. Changes from the APTD-0581 document and allowable modifications to Figure 8-1 are discussed in the following subsections.

The operating and maintenance procedures for the sampling train are described in APTD-0576. Since correct usage is important in obtaining valid results, all users should read the APTD-0576 document and adopt the operating and maintenance procedures outlined in it, unless otherwise specified herein. Further details and guidelines on operation and maintenance are given in Method 5 and should be read and followed whenever they are applicable.

2.1.1 Probe Nozzle. Same as Method 5, Section 2.1.1.

2.1.2 Probe Liner. Borosilicate or quartz glass, with a heating system to prevent visible condensation during sampling. Do not use metal probe liners.

2.1.3 Pitot Tube. Same as Method 5, Section 2.1.3.

2.1.4 Differential Pressure Gauge. Same as Method 5, Section 2.1.4.

2.1.5 Filter Holder. Borosilicate glass, with a glass frit filter support and a silicone rubber gasket. Other gasket materials, e.g., Teflon or Viton, may be used subject to the approval of the Administrator. The holder design shall provide a positive seal against leakage from the outside or around the filter. The filter holder shall be placed between the first and second impingers. Note: Do not heat the filter holder.

2.1.6 Impingers—Four, as shown in Figure 8-1. The first and third shall be of the Greenburg-Smith design with standard tips. The second and fourth shall be of the Greenburg-Smith design, modified by replacing the insert with an approximately 13 millimeter (0.5 in.) ID glass tube, having an unconstricted tip located 13 mm (0.5 in.) from the bottom of the flask. Similar collection systems, which have been approved by the Administrator, may be used.

2.1.7 Metering System. Same as Method 5, Section 2.1.8.

2.1.8 Barometer. Same as Method 5, Section 2.1.9.

2.1.9 Gas Density Determination Equipment. Same as Method 5, Section 2.1.10.

2.1.10 Temperature Gauge. Thermometer, or equivalent, to measure the temperature of the gas leaving the impinger train to within 1° C (2° F).

2.2 Sample Recovery.

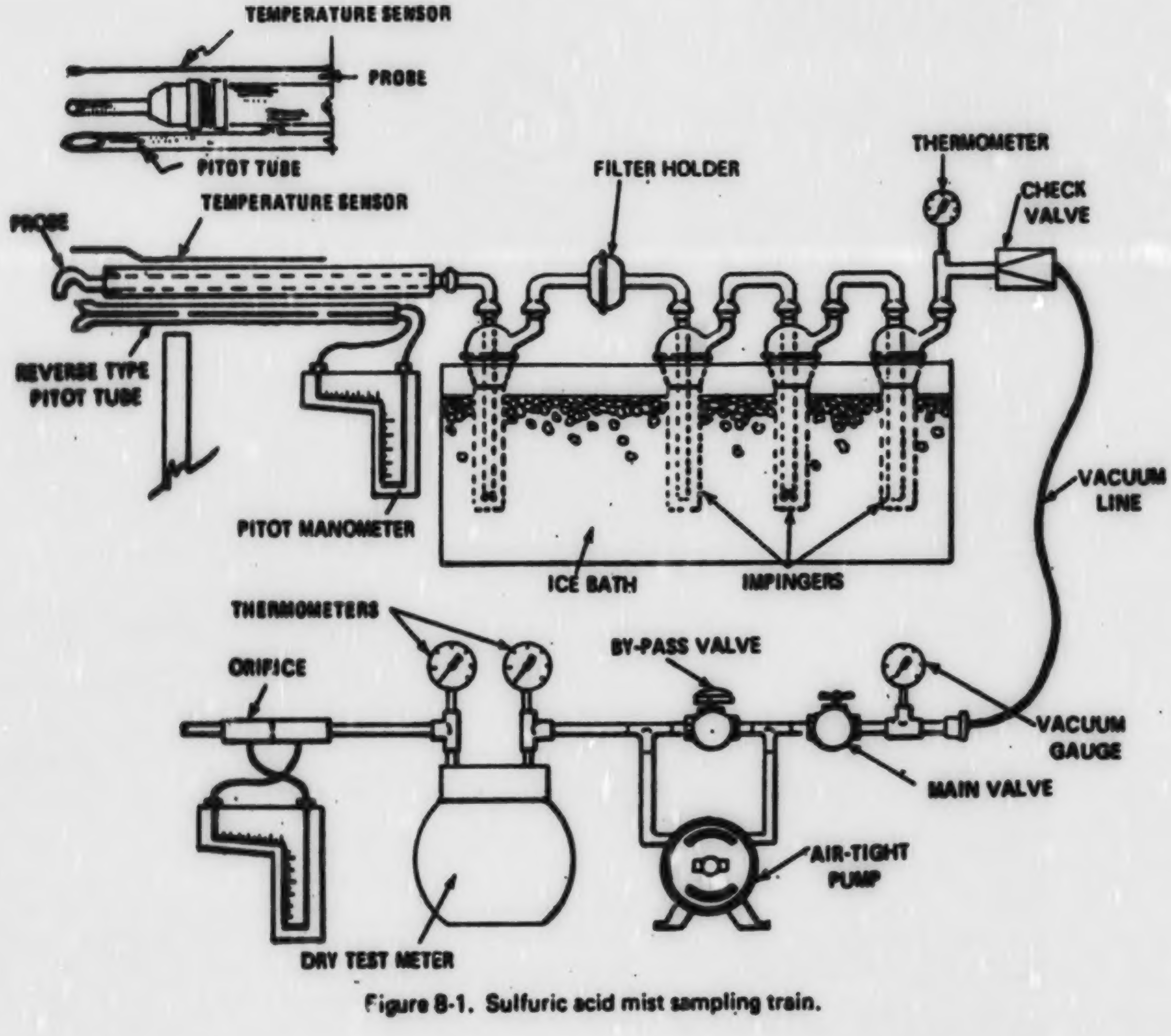

Figure 8-1. Sulfuric acid mist sampling train.

2.2.1 Wash Bottles. Polyethylene or glass, 500 ml. (two).

2.2.2 Graduated Cylinders. 250 ml, 1 liter. (Volumetric flasks may also be used.)

2.2.3 Storage Bottles. Leak-free polyethylene bottles, 1000 ml size (two for each sampling run).

2.2.4 Trip Balance. 500-gram capacity, to measure to ±0.5 g (necessary only if a moisture content analysis is to be done).

2.3 Analysis.

2.3.1 Pipettes. Volumetric 25 ml, 100 ml.

2.3.2 Burrette. 50 ml.

2.3.3 Erlenmeyer Flask. 250 ml. (one for each sample blank and standard).

2.3.4 Graduated Cylinder. 100 ml.

2.3.5 Trip Balance. 500 g capacity, to measure to ±0.5 g.

2.3.6 Dropping Bottle. To add indicator solution, 125-ml size.

3. *Reagents*

Unless otherwise indicated, all reagents are to conform to the specifications established by the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available. Otherwise, use the best available grade.

3.1 Sampling.

3.1.1 Filters. Same as Method 5, Section 3.1.1.

3.1.2 Silica Gel. Same as Method 5, Section 3.1.2.

3.1.3 Water. Deionized, distilled to conform to ASTM specification D1193-74, Type 3. At the option of the analyst, the $KMnO_4$ test for oxidizable organic matter may be omitted when high concentrations of organic matter are not expected to be present.

3.1.4 Isopropanol, 80 Percent. Mix 800 ml of isopropanol with 200 ml of deionized, distilled water.

NOTE.—Experience has shown that only A.C.S. grade isopropanol is satisfactory. Tests have shown that isopropanol obtained from commercial sources occasionally has peroxide impurities that will cause erroneously high sulfuric acid mist measurement. Use the following test for detecting peroxides in each lot of isopropanol: Shake 10 ml of the isopropanol with 10 ml of freshly prepared 10 percent potassium iodide solution. Prepare a blank by similarly treating 10 ml of distilled water. After 1 minute, read the absorbance on a spectrophotometer at 352 nanometers. If the absorbance exceeds 0.1, the isopropanol shall not be used. Peroxides may be removed from isopropanol by redistilling, or by passage through a column of activated alumina. However, reagent-grade isopropanol with suitably low peroxide levels is readily available from commercial sources; therefore, rejection of contaminated lots may be more efficient than following the peroxide removal procedure.

3.1.5 Hydrogen Peroxide, 3 Percent. Dilute 100 ml of 30 percent hydrogen peroxide to 1 liter with deionized, distilled water. Prepare fresh daily.

3.1.6 Crushed Ice.

3.2 Sample Recovery.

3.2.1 Water. Same as 3.1.3.

3.2.2 Isopropanol, 80 Percent. Same as 3.1.4.

3.3 Analysis.

3.3.1 Water. Same as 3.1.3.

3.3.2 Isopropanol, 100 Percent.

3.3.3 Thorin Indicator. 1-(o-arsonophenylazo)-2-naphthol-3, 6-disulfonic acid, disodium salt, or equivalent. Dissolve 0.20 g in 100 ml of deionized, distilled water.

3.3.4 Barium Perchlorate (0.0100 Normal). Dissolve 1.95 g of barium perchlorate trihydrate ($Ba(ClO_4)_2 \cdot 3H_2O$) in 200 ml deionized, distilled water, and dilute to 1 liter with isopropanol; 1.22 g of barium chloride dihydrate ($BaCl_2 \cdot 2H_2O$) may be used instead of the barium perchlorate. Standardize with sulfuric acid as in Section 5.2. This solution must be protected against evaporation at all times.

3.3.5 Sulfuric Acid Standard (0.0100 N). Purchase or standardize to ±0.0002 N against 0.0100 N NaOH that has previously been standardized against primary standard potassium acid phthalate.

4. *Procedure*

4.1 Sampling.

4.1.1 Pretest Preparation. Follow the procedure outlined in Method 5, Section 4.1.1; filters should be inspected, but need not be desiccated, weighed, or identified. If the effluent gas can be considered dry, i.e., moisture free, the silica gel need not be weighed.

4.1.2 Preliminary Determinations. Follow the procedure outlined in Method 5, Section 4.1.2.

4.1.3 Preparation of Collection Train. Follow the procedure outlined in Method 5, Section 4.1.3 (except for the second paragraph and other obviously inapplicable parts) and use Figure 8-1 instead of Figure 5-1. Replace the second paragraph with: Place 100 ml of 80 percent isopropanol in the first impinger, 100 ml of 3 percent hydrogen peroxide in both the second and third impingers; retain a portion of each reagent for use as a blank solution. Place about 200 g of silica gel in the fourth impinger.

PLANT ____________

LOCATION ____________

OPERATOR ____________

DATE ____________

RUN NO. ____________

SAMPLE BOX NO. ____________

METER BOX NO. ____________

METER ΔH@ ____________

C FACTOR ____________

PITOT TUBE COEFFICIENT, C_p ____________

SCHEMATIC OF STACK CROSS SECTION

STATIC PRESSURE, mm Hg (in. Hg) ____________

AMBIENT TEMPERATURE ____________

BAROMETRIC PRESSURE ____________

ASSUMED MOISTURE, % ____________

PROBE LENGTH, m (ft) ____________

NOZZLE IDENTIFICATION NO. ____________

AVERAGE CALIBRATED NOZZLE DIAMETER, cm (in.) ____________

PROBE HEATER SETTING ____________

LEAK RATE, m^3/min, (cfm) ____________

PROBE LINER MATERIAL ____________

FILTER NO. ____________

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min.	VACUUM mm Hg (in. Hg)	STACK TEMPERATURE (T_S), °C (°F)	VELOCITY HEAD (ΔP_S), mm H_2O (in. H_2O)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER, mm H_2O (in. H_2O)	GAS SAMPLE VOLUME, m^3 (ft^3)	GAS SAMPLE TEMPERATURE AT DRY GAS METER		TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER, °C (°F)
							INLET, °C (°F)	OUTLET, °C (°F)	
TOTAL							Avg	Avg	
AVERAGE							Avg		

Figure 8-2. Field data.

NOTE.—If moisture content is to be determined by impinger analysis, weigh each of the first three impingers (plus absorbing solution) to the nearest 0.5 g and record these weights. The weight of the silica gel (or silica gel plus container) must also be determined to the nearest 0.5 g and recorded.

4.1.4 Pretest Leak-Check Procedure. Follow the basic procedure outlined in Method 5, Section 4.1.4.1, noting that the probe heater shall be adjusted to the minimum temperature required to prevent condensation, and also that verbage such as, "* * * plugging the inlet to the filter holder * * *," shall be replaced by, "* * * plugging the inlet to the first impinger * * *." The pretest leak-check is optional.

4.1.5 Train Operation. Follow the basic procedures outlined in Method 5, Section 4.1.5, in conjunction with the following special instructions. Data shall be recorded on a sheet similar to the one in Figure 8-2. The sampling rate shall not exceed 0.030 m³/min (1.0 cfm) during the run. Periodically during the test, observe the connecting line between the probe and first impinger for signs of condensation. If it does occur, adjust the probe heater setting upward to the minimum temperature required to prevent condensation. If component changes become necessary during a run, a leak-check shall be done immediately before each change, according to the procedure outlined in Section 4.1.4.2 of Method 5 (with appropriate modifications, as mentioned in Section 4.1.4 of this method); record all leak rates. If the leakage rate(s) exceed the specified rate, the tester shall either void the run or shall plan to correct the sample volume as outlined in Section 6.3 of Method 5. Immediately after component changes, leak-checks are optional. If these leak-checks are done, the procedure outlined in Section 4.1.4.1 of Method 5 (with appropriate modifications) shall be used.

After turning off the pump and recording the final readings at the conclusion of each run, remove the probe from the stack. Conduct a post-test (mandatory) leak-check as in Section 4.1.4.3 of Method 5 (with appropriate modification) and record the leak rate. If the post-test leakage rate exceeds the specified acceptable rate, the tester shall either correct the sample volume, as outlined in Section 6.3 of Method 5, or shall void the run.

Drain the ice bath and, with the probe disconnected, purge the remaining part of the train, by drawing clean ambient air through the system for 15 minutes at the average flow rate used for sampling.

NOTE.—Clean ambient air can be provided by passing air through a charcoal filter. At the option of the tester, ambient air (without cleaning) may be used.

4.1.6 Calculation of Percent Isokinetic. Follow the procedure outlined in Method 5, Section 4.1.6.

4.2 Sample Recovery.

4.2.1 Container No. 1. If a moisture content analysis is to be done, weigh the first impinger plus contents to the nearest 0.5 g and record this weight.

Transfer the contents of the first impinger to a 250-ml graduated cylinder. Rinse the probe, first impinger, all connecting glassware before the filter, and the front half of the filter holder with 80 percent isopropanol. Add the rinse solution to the cylinder. Dilute to 250 ml with 80 percent isopropanol. Add the filter to the solution, mix, and transfer to the storage container. Protect the solution against evaporation. Mark the level of liquid on the container and identify the sample container.

4.2.2 Container No. 2. If a moisture content analysis is to be done, weigh the second and third impingers (plus contents) to the nearest 0.5 g and record these weights. Also, weigh the spent silica gel (or silica gel plus impinger) to the nearest 0.5 g.

Transfer the solutions from the second and third impingers to a 1000-ml graduated cylinder. Rinse all connecting glassware (including back half of filter holder) between the filter and silica gel impinger with deionized, distilled water, and add this rinse water to the cylinder. Dilute to a volume of 1000 ml with deionized, distilled water. Transfer the solution to a storage container. Mark the level of liquid on the container. Seal and identify the sample container.

4.3 Analysis.

Note the level of liquid in containers 1 and 2, and confirm whether or not any sample was lost during shipment; note this on the analytical data sheet. If a noticeable amount of leakage has occurred, either void the sample or use methods, subject to the approval of the Administrator, to correct the final results.

4.3.1 Container No. 1. Shake the container holding the isopropanol solution and the filter. If the filter breaks up, allow the fragments to settle for a few minutes before removing a sample. Pipette a 100-ml aliquot of this solution into a 250-ml Erlenmeyer flask, add 2 to 4 drops of thorin indicator, and titrate to a pink endpoint using 0.0100 N barium perchlorate. Repeat the titration with a second aliquot of sample and average the titration values. Replicate titrations must agree within 1 percent or 0.2 ml, whichever is greater.

4.3.2 Container No. 2. Thoroughly mix the solution in the container holding the contents of the second and third impingers. Pipette a 10-ml aliquot of sample into a 250-ml Erlenmeyer flask. Add 40 ml of isopropanol, 2 to 4 drops of thorin indicator, and titrate to a pink endpoint using 0.0100 N barium perchlorate. Repeat the titration with a second aliquot of sample and average the titration values. Replicate titrations must agree within 1 percent or 0.2 ml, whichever is greater.

4.3.3 Blanks. Prepare blanks by adding 2 to 4 drops of thorin indicator to 100 ml of 80 percent isopropanol. Titrate the blanks in the same manner as the samples.

5. Calibration

5.1 Calibrate equipment using the procedures specified in the following sections of Method 5: Section 5.3 (metering system); Section 5.5 (temperature gauges); Section 5.7 (barometer). Note that the recommended leak-check of the metering system, described in Section 5.6 of Method 5, also applies to this method.

5.2 Standardize the barium perchlorate solution with 25 ml of standard sulfuric acid, to which 100 ml of 100 percent isopropanol has been added.

6. Calculations

NOTE.—Carry out calculations retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after final calculation.

6.1 Nomenclature.

A_n = Cross-sectional area of nozzle, m² (ft²).
B_{ws} = Water vapor in the gas stream, proportion by volume.
$C_{H_2SO_4}$ = Sulfuric acid (including SO_3) concentration, g/dscm (lb/dscf).
C_{SO_2} = Sulfur dioxide concentration, g/dscm (lb/dscf).
I = Percent of isokinetic sampling.
N = Normality of barium perchlorate titrant, g equivalents/liter.
P_{bar} = Barometric pressure at the sampling site, mm Hg (in. Hg).
P_s = Absolute stack gas pressure, mm Hg (in. Hg).
P_{std} = Standard absolute pressure, 760 mm Hg (29.92 in. Hg).
T_m = Average absolute dry gas meter temperature (see Figure 8-2), °K (°R).
T_s = Average absolute stack gas temperature (see Figure 8-2), °K (°R).
T_{std} = Standard absolute temperature, 293° K (528° R).
V_a = Volume of sample aliquot titrated, 100 ml for H_2SO_4 and 10 ml for SO_2.
V_{lc} = Total volume of liquid collected in impingers and silica gel, ml.
V_m = Volume of gas sample as measured by dry gas meter, dcm (dcf).
$V_{m(std)}$ = Volume of gas sample measured by the dry gas meter corrected to standard conditions, dscm (dscf).
v_s = Average stack gas velocity, calculated by Method 2, Equation 2-9, using data obtained from Method 8, m/sec (ft/sec).
V_{soln} = Total volume of solution in which the sulfuric acid or sulfur dioxide sample is contained, 250 ml or 1,000 ml, respectively.
V_t = Volume of barium perchlorate titrant used for the sample, ml.
V_{tb} = Volume of barium perchlorate titrant used for the blank, ml.
Y = Dry gas meter calibration factor.
ΔH = Average pressure drop across orifice meter, mm (in.) H_2O.
θ = Total sampling time, min.
13.6 = Specific gravity of mercury.
60 = sec/min.
100 = Conversion to percent.

6.2 Average dry gas meter temperature and average orifice pressure drop. See data sheet (Figure 8-2).

6.3 Dry Gas Volume. Correct the sample volume measured by the dry gas meter to standard conditions (20° C and 760 mm Hg or 68° F and 29.92 in. Hg) by using Equation 8-1.

$$V_{m(std)} = V_m Y \left(\frac{T_{std}}{T_m}\right) \frac{P_{bar} + \left(\frac{\Delta H}{13.6}\right)}{P_{std}}$$

$$= K_1 V_m Y \frac{P_{bar} + (\Delta H/13.6)}{T_m}$$

Equation 8-1

where:
K_1 = 0.3858 °K/mm Hg for metric units.
= 17.64 °R/in. Hg for English units.

NOTE.—If the leak rate observed during any mandatory leak-checks exceeds the specified acceptable rate, the tester shall either correct the value of V_m in Equation 8-1 (as described in Section 6.3 of Method 5), or shall invalidate the test run.

6.4 Volume of Water Vapor and Moisture Content. Calculate the volume of water vapor using Equation 5-2 of Method 5; the weight of water collected in the impingers and silica gel can be directly converted to milliliters (the specific gravity of water is 1 g/ml). Calculate the moisture content of the stack gas, using Equation 5-3 of Method 5. The "Note" in Section 6.5 of Method 5 also applies to this method. Note that if the effluent gas stream can be considered dry, the volume of water vapor and moisture content need not be calculated.

6.5 Sulfuric acid mist (including SO_3) concentration.

$$C_{H_2SO_4} = K_2 \frac{N(V_t - V_{tb})\left(\frac{V_{soln}}{V_a}\right)}{V_{m(std)}}$$

Equation 8-2

where:
K_2 = 0.04904 g/milliequivalent for metric units.
= 1.081×10^{-4} lb/meq for English units.

6.6 Sulfur dioxide concentration.

$$C_{SO_2} = K_3 \frac{N(V_t - V_{tb})\left(\frac{V_{soln}}{V_a}\right)}{V_{m(std)}}$$

Equation 8-3

where:
K_3 = 0.03203 g/meq for metric units.
= 7.061×10^{-5} lb/meq for English units.

6.7 Isokinetic Variation.

6.7.1 Calculation from raw data.

$$I = \frac{100\, T_s [K_4 V_{lc} + (V_m/T_m)\, P_{bar} + \Delta H/13.6)]}{60\, \theta\, V_s P_s A_n}$$

Equation 8-4

where:
K_4 = 0.003464 mm Hg-m³/ml-°K for metric units.
= 0.002676 in. Hg-ft³/ml-° R for English units.

6.7.2 Calculation from intermediate values.

$$I = \frac{T_s V_{m(std)} P_{std}\, 100}{T_{std} v_s \theta A_n P_s\, 60\, (1 - B_{ws})}$$

$$= K_5 \frac{T_s V_{m(std)}}{P_s v_s A_n \theta (1 - B_{ws})}$$

Equation 8-5

where:
K_5 = 4.320 for metric units.
= 0.09450 for English units.

6.8 Acceptable Results. If 90 percent ≤I ≤110 percent, the results are acceptable. If the results are low in comparison to the standards and I is beyond the acceptable range, the Administrator may opt to accept the results. Use Citation 4 in the Bibliography of Method 5 to make judgments. Otherwise, reject the results and repeat the test.

7. Bibliography

1. Atmospheric Emissions from Sulfuric Acid Manufacturing Processes. U.S. DHEW, PHS, Division of Air Pollution. Public Health Service Publication No. 999-AP-13. Cincinnati, Ohio. 1965.

2. Corbett, P. F. The Determination of SO_2 and SO_3 in Flue Gases. Journal of the Institute of Fuel. 24:237-243. 1961.

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4. Patton, W. F., and J. A. Brink, Jr. New Equipment and Techniques for Sampling Chemical Process Gases. Journal of Air Pollution Control Association. 13:162. 1963.

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7. Annual Book of ASTM Standards. Part 31; Water, Atmospheric Analysis. pp. 40-42. American Society for Testing and Materials. Philadelphia, Pa. 1974.

METHOD 9—VISUAL DETERMINATION OF THE OPACITY OF EMISSIONS FROM STATIONARY SOURCES 10

Many stationary sources discharge visible emissions into the atmosphere; these emissions are usually in the shape of a plume. This method involves the determination of plume opacity by qualified observers. The method includes procedures for the training and certification of observers, and procedures to be used in the field for determination of plume opacity. The appearance of a plume as viewed by an observer depends upon a number of variables, some of which may be controllable and some of which may not be controllable in the field. Variables which can be controlled to an extent to which they no longer exert a significant influence upon plume appearance include: Angle of the observer with respect to the plume; angle of the observer with respect to the sun; point of observation of attached and detached steam plume; and angle of the observer with respect to a plume emitted from a rectangular stack with a large length to width ratio. The method includes specific criteria applicable to these variables.

Other variables which may not be controllable in the field are luminescence and color contrast between the plume and the background against which the plume is viewed. These variables exert an influence upon the appearance of a plume as viewed by an observer, and can affect the ability of the observer to accurately assign opacity values to the observed plume. Studies of the theory of plume opacity and field studies have demonstrated that a plume is most visible and presents the greatest apparent opacity when viewed against a contrasting background. It follows from this, and is confirmed by field trials, that the opacity of a plume, viewed under conditions where a contrasting background is present can be assigned with the greatest degree of accuracy. However, the potencial for a positive error is also the greatest when a plume is viewed under such contrasting conditions. Under conditions presenting a less contrasting background, the apparent opacity of a plume is less and approaches zero as the color and luminescence contrast decrease toward zero. As a result, significant negative bias and negative errors can be made when a plume is viewed under less contrasting conditions. A negative bias decreases rather than increases the possibility that a plant operator will be cited for a violation of opacity standards due to observer error.

Studies have been undertaken to determine the magnitude of positive errors which can be made by qualified observers while reading plumes under contrasting conditions and using the procedures set forth in this method. The results of these studies (field trials) which involve a total of 769 sets of 25 readings each are as follows:

(1) For black plumes (133 sets at a smoke generator), 100 percent of the sets were read with a positive error[1] of less than 7.5 percent opacity; 99 percent were read with a positive error of less than 5 percent opacity.

(2) For white plumes (170 sets at a smoke generator, 168 sets at a coal-fired power plant, 298 sets at a sulfuric acid plant), 99 percent of the sets were read with a positive error of less than 7.5 percent opacity; 95 percent were read with a positive error of less than 5 percent opacity.

The positive observational error associated with an average of twenty-five readings is therefore established. The accuracy of the method must be taken into account when determining possible violations of applicable opacity standards.

1. *Principle and applicability.*

1.1 Principle. The opacity of emissions from stationary sources is determined visually by a qualified observer.

1.2 Applicability. This method is applicable for the determination of the opacity of emissions from stationary sources pursuant to § 60.11(b) and for qualifying observers for visually determining opacity of emissions.

2. *Procedures.* The observer qualified in accordance with paragraph 3 of this method shall use the following procedures for visually determining the opacity of emissions:

2.1 Position. The qualified observer shall stand at a distance sufficient to provide a clear view of the emissions with the sun oriented in the 140° sector to his back. Consistent with maintaining the above requirement, the observer shall, as much as possible, make his observations from a position such that his line of vision is approximately perpendicular to the plume direction, and when observing opacity of emissions from rectangular outlets (e.g. roof monitors, open baghouses, noncircular stacks), approximately perpendicular to the longer axis of the outlet. The observer's line of sight should not include more than one plume at a time when multiple stacks are involved, and in any case the observer should make his observations with his line of sight perpendicular to the longer axis of such a set of multiple stacks (e.g. stub stacks on baghouses).

2.2 Field records. The observer shall record the name of the plant, emission location, type facility, observer's name and affiliation, and the date on a field data sheet (Figure 9–1). The time, estimated distance to the emission location, approximate wind direction, estimated wind speed, description of the sky condition (presence and color of clouds), and plume background are recorded on a field data sheet at the time opacity readings are initiated and completed.

2.3 Observations. Opacity observations shall be made at the point of greatest opacity in that portion of the plume where condensed water vapor is not present. The observer shall not look continuously at the plume, but instead shall observe the plume momentarily at 15-second intervals.

2.3.1 Attached steam plumes. When condensed water vapor is present within the plume as it emerges from the emission outlet, opacity observations shall be made beyond the point in the plume at which condensed water vapor is no longer visible. The observer shall record the approximate distance from the emission outlet to the point in the plume at which the observations are made.

2.3.2 Detached steam plume. When water vapor in the plume condenses and becomes visible at a distinct distance from the emission outlet, the opacity of emissions should be evaluated at the emission outlet prior to the condensation of water vapor and the formation of the steam plume.

2.4 Recording observations. Opacity observations shall be recorded to the nearest 5 percent at 15-second intervals on an observational record sheet. (See Figure 9–2 for an example.) A minimum of 24 observations shall be recorded. Each momentary observation recorded shall be deemed to represent the average opacity of emissions for a 15-second period.

2.5 Data Reduction. Opacity shall be determined as an average of 24 consecutive observations recorded at 15-second intervals. Divide the observations recorded on the record sheet into sets of 24 consecutive observations. A set is composed of any 24 consecutive observations. Sets need not be consecutive in time and in no case shall two sets overlap. For each set of 24 observations, calculate the average by summing the opacity of the 24 observations and dividing this sum by 24. If an applicable standard specifies an averaging time requiring more than 24 observations, calculate the average for all observations made during the specified time period. Record the average opacity on a record sheet. (See Figure 9–1 for an example.)

3. *Qualifications and testing.*

3.1 Certification requirements. To receive certification as a qualified observer, a candidate must be tested and demonstrate the ability to assign opacity readings in 5 percent increments to 25 different black plumes and 25 different white plumes, with an error not to exceed 15 percent opacity on any one reading and an average error not to exceed 7.5 percent opacity in each category. Candidates shall be tested according to the procedures described in paragraph 3.2. Smoke generators used pursuant to paragraph 3.2 shall be equipped with a smoke meter which meets the requirements of paragraph 3.3.

The certification shall be valid for a period of 6 months, at which time the qualification procedure must be repeated by any observer in order to retain certification.

3.2 Certification procedure. The certification test consists of showing the candidate a complete run of 50 plumes—25 black plumes and 25 white plumes—generated by a smoke generator. Plumes within each set of 25 black and 25 white runs shall be presented in random order. The candidate assigns an opacity value to each plume and records his observation on a suitable form. At the completion of each run of 50 readings, the score of the candidate is determined. If a candidate fails to qualify, the complete run of 50 readings must be repeated in any retest. The smoke test may be administered as part of a smoke school or training program, and may be preceded by training or familiarization runs of the smoke generator during which candidates are shown black and white plumes of known opacity.

3.3 Smoke generator specifications. Any smoke generator used for the purposes of paragraph 3.2 shall be equipped with a smoke meter installed to measure opacity across the diameter of the smoke generator stack. The smoke meter output shall display in-stack opacity based upon a pathlength equal to the stack exit diameter, on a full 0 to 100 percent chart recorder scale. The smoke meter optical design and performance shall meet the specifications shown in Table 9–1. The smoke meter shall be calibrated as prescribed in paragraph 3.3.1 prior to the conduct of each smoke reading test. At the completion of each test, the zero and span drift shall be checked and if the drift exceeds ±1 percent opacity, the condition shall be corrected prior to conducting any subsequent test runs. The smoke meter shall be demonstrated, at the time of installation, to meet the specifications listed in Table 9–1. This demonstration shall be repeated following any subsequent repair or replacement of the photocell or associated electronic circuitry including the chart recorder or output meter, or every 6 months, whichever occurs first.

3.3.1 Calibration. The smoke meter is calibrated after allowing a minimum of 30 minutes warmup by alternately producing simulated opacity of 0 percent and 100 percent. When stable response at 0 percent or 100 percent is noted, the smoke meter is adjusted to produce an output of 0 percent or 100 percent, as appropriate. This calibration shall be repeated until stable 0 percent and 100 percent readings are produced without adjustment. Simulated 0 percent and 100 percent opacity values may be produced by alternately switching the power to the light source on and off while the smoke generator is not producing smoke.

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[1] For a set, positive error = average opacity determined by observers' 25 observations − average opacity determined from transmissometer's 25 recordings.

TABLE 9-1—SMOKE METER DESIGN AND PERFORMANCE SPECIFICATIONS

Parameter:	Specification
a. Light source	Incandescent lamp operated at nominal rated voltage.
b. Spectral response of photocell.	Photopic (daylight spectral response of the human eye—reference 4.3).
c. Angle of view	15° maximum total angle.
d. Angle of projection.	15° maximum total angle.
e. Calibration error.	±3% opacity, maximum.
f. Zero and span drift.	±1% opacity, 30 minutes.
g. Response time	≤5 seconds.

3.3.2 Smoke meter evaluation. The smoke meter design and performance are to be evaluated as follows:

3.3.2.1 Light source. Verify from manufacturer's data and from voltage measurements made at the lamp, as installed, that the lamp is operated within ±5 percent of the nominal rated voltage.

3.3.2.2 Spectral response of photocell. Verify from manufacturer's data that the photocell has a photopic response; i.e., the spectral sensitivity of the cell shall closely approximate the standard spectral-luminosity curve for photopic vision which is referenced in (b) of Table 9-1.

3.3.2.3 Angle of view. Check construction geometry to ensure that the total angle of view of the smoke plume, as seen by the photocell, does not exceed 15°. The total angle of view may be calculated from: $\theta=2 \tan^{-1} d/2L$, where θ=total angle of view; d=the sum of the photocell diameter+the diameter of the limiting aperture; and L=the distance from the photocell to the limiting aperture. The limiting aperture is the point in the path between the photocell and the smoke plume where the angle of view is most restricted. In smoke generator smoke meters this is normally an orifice plate.

3.3.2.4 Angle of projection. Check construction geometry to ensure that the total angle of projection of the lamp on the smoke plume does not exceed 15°. The total angle of projection may be calculated from: $\theta=2 \tan^{-1} d/2L$, where θ= total angle of projection; d= the sum of the length of the lamp filament + the diameter of the limiting aperture; and L= the distance from the lamp to the limiting aperture.

3.3.2.5 Calibration error. Using neutral-density filters of known opacity, check the error between the actual response and the theoretical linear response of the smoke meter. This check is accomplished by first calibrating the smoke meter according to 3.3.1 and then inserting a series of three neutral-density filters of nominal opacity of 20, 50, and 75 percent in the smoke meter pathlength. Filters calibarted within ±2 percent shall be used. Care should be taken when inserting the filters to prevent stray light from affecting the meter. Make a total of five nonconsecutive readings for each filter. The maximum error on any one reading shall be 3 percent opacity.

3.3.2.6 Zero and span drift. Determine the zero and span drift by calibrating and operating the smoke generator in a normal manner over a 1-hour period. The drift is measured by checking the zero and span at the end of this period.

3.3.2.7 Response time. Determine the response time by producng the series of five simulated 0 percent and 100 percent opacity values and observing the time required to reach stable response. Opacity values of 0 percent and 100 percent may be simulated by alternately switching the power to the light source off and on while the smoke generator is not operating.

4. *References.*

4.1 Air Pollution Control District Rules and Regulations, Los Angeles County Air Pollution Control District, Regulation IV, Prohibitions, Rule 50.

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FIGURE 9-1
RECORD OF VISUAL DETERMINATION OF OPACITY

PAGE___of___

COMPANY________________
LOCATION________________
TEST NUMBER________________
DATE________________
TYPE FACILITY________________
CONTROL DEVICE________________

HOURS OF OBSERVATION________________
OBSERVER________________
OBSERVER CERTIFICATION DATE________________
OBSERVER AFFILIATION________________
POINT OF EMISSIONS________________
HEIGHT OF DISCHARGE POINT________________

CLOCK TIME	Initial			Final
OBSERVER LOCATION Distance to Discharge				
Direction from Discharge				
Height of Observation Point				
BACKGROUND DESCRIPTION				
WEATHER CONDITIONS Wind Direction				
Wind Speed				
Ambient Temperature				
SKY CONDITIONS (clear, overcast, % clouds, etc.)				
PLUME DESCRIPTION Color				
Distance Visible				
OTHER INFORMATION				

SUMMARY OF AVERAGE OPACITY

Set Number	Time	Opacity	
	Start--End	Sum	Average

Readings ranged from ____ to ____ % opacity

The source was/was not in compliance with ____ at the time evaluation was made.

FIGURE 9-2 OBSERVATION RECORD

PAGE ___ OF ___

COMPANY __________
LOCATION __________
TEST NUMBER __________
DATE __________

OBSERVER __________
TYPE FACILITY __________
POINT OF EMISSIONS __________

Hr.	Min.	Seconds				STEAM PLUME (check if applicable)		COMMENTS
		0	15	30	45	Attached	Detached	
	0							
	1							
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
	11							
	12							
	13							
	14							
	15							
	16							
	17							
	18							
	19							
	20							
	21							
	22							
	23							
	24							
	25							
	26							
	27							
	28							
	29							

FIGURE 9-2 OBSERVATION RECORD (Continued)

PAGE ___ OF ___

COMPANY __________
LOCATION __________
TEST NUMBER __________
DATE __________

OBSERVER __________
TYPE FACILITY __________
POINT OF EMISSIONS __________

Hr.	Min.	Seconds				STEAM PLUME (check if applicable)		COMMENTS
		0	15	30	45	Attached	Detached	
	30							
	31							
	32							
	33							
	34							
	35							
	36							
	37							
	38							
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METHOD 10—DETERMINATION OF CARBON MONOXIDE EMISSIONS FROM STATIONARY SOURCES[5]

1. *Principle and Applicability.*

1.1 *Principle.* An integrated or continuous gas sample is extracted from a sampling point and analyzed for carbon monoxide (CO) content using a Luft-type nondispersive infrared analyzer (NDIR) or equivalent.

1.2 *Applicability.* This method is applicable for the determination of carbon monoxide emissions from stationary sources only when specified by the test procedures for determining compliance with new source performance standards. The test procedure will indicate whether a continuous or an integrated sample is to be used.

2. *Range and sensitivity.*

2.1 *Range.* 0 to 1,000 ppm.

2.2 *Sensitivity.* Minimum detectable concentration is 20 ppm for a 0 to 1,000 ppm span.

3. *Interferences.* Any substance having a strong absorption of infrared energy will interfere to some extent. For example, discrimination ratios for water (H_2O) and carbon dioxide (CO_2) are 3.5 percent H_2O per 7 ppm CO and 10 percent CO_2 per 10 ppm CO, respectively, for devices measuring in the 1,500 to 3,000 ppm range. For devices measuring in the 0 to 100 ppm range, interference ratios can be as high as 3.5 percent H_2O per 25 ppm CO and 10 percent CO_2 per 50 ppm CO. The use of silica gel and ascarite traps will alleviate the major interference problems. The measured gas volume must be corrected if these traps are used.

4. *Precision and accuracy.*

4.1 *Precision.* The precision of most NDIR analyzers is approximately ±2 percent of span.

4.2 *Accuracy.* The accuracy of most NDIR analyzers is approximately ±5 percent of span after calibration.

5. *Apparatus.*

5.1 *Continuous sample* (Figure 10–1).

5.1.1 *Probe.* Stainless steel or sheathed Pyrex[1] glass, equipped with a filter to remove particulate matter.

5.1.2 *Air-cooled condenser or equivalent.* To remove any excess moisture.

5.2 *Integrated sample* (Figure 10–2).

5.2.1 *Probe.* Stainless steel or sheathed Pyrex glass, equipped with a filter to remove particulate matter.

5.2.2 *Air-cooled condenser or equivalent.* To remove any excess moisture.

5.2.3 *Valve.* Needle valve, or equivalent, to to adjust flow rate.

5.2.4 *Pump.* Leak-free diaphragm type, or equivalent, to transport gas.

5.2.5 *Rate meter.* Rotameter, or equivalent, to measure a flow range from 0 to 1.0 liter per min. (0.035 cfm).

5.2.6 *Flexible bag.* Tedlar, or equivalent, with a capacity of 60 to 90 liters (2 to 3 ft ^{3}). Leak-test the bag in the laboratory before using by evacuating bag with a pump followed by a dry gas meter. When evacuation is complete, there should be no flow through the meter.

5.2.7 *Pitot tube.* Type S, or equivalent, attached to the probe so that the sampling rate can be regulated proportional to the stack gas velocity when velocity is varying with the time or a sample traverse is conducted.

5.3 *Analysis* (Figure 10–3).

TABLE 10–1.—*Field data*

Location ____________________ Comments:
Test ____________________
Date ____________________
Operator ____________________

Clock time	*Rotameter setting, liters per minute (cubic feet per minute)*

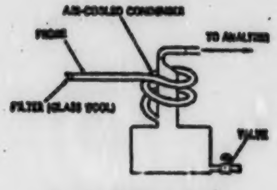

Figure 10-1. Continuous sampling train.

5.3.1 *Carbon monoxide analyzer.* Nondispersive infrared spectrometer, or equivalent. This instrument should be demonstrated, preferably by the manufacturer, to meet or exceed manufacturer's specifications and those described in this method.

5.3.2 *Drying tube.* To contain approximately 200 g of silica gel.

5.3.3 *Calibration gas.* Refer to paragraph 6.1.

5.3.4 *Filter.* As recommended by NDIR manufacturer.

5.3.5 *CO_2 removal tube.* To contain approximately 500 g of ascarite.

5.3.6 *Ice water bath.* For ascarite and silica gel tubes.

5.3.7 *Valve.* Needle valve, or equivalent, to adjust flow rate

5.3.8 *Rate meter.* Rotameter or equivalent to measure gas flow rate of 0 to 1.0 liter per min. (0.035 cfm) through NDIR.

5.3.9 *Recorder* (*optional*). To provide permanent record of NDIR readings.

6. *Reagents.*

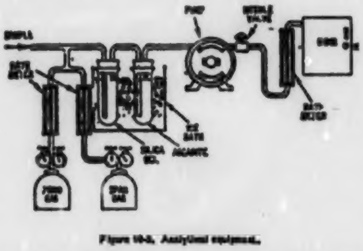

Figure 10-3. Analytical equipment.

6.1 *Calibration gases.* Known concentration of CO in nitrogen (N_2) for instrument span, prepurified grade of N_2 for zero, and two additional concentrations corresponding approximately to 60 percent and 30 percent span. The span concentration shall not exceed 1.5 times the applicable source performance standard. The calibration gases shall be certified by the manufacturer to be within ±2 percent of the specified concentration.

6.2 *Silica gel.* Indicating type, 6 to 16 mesh, dried at 175° C (347° F) for 2 hours.

6.3 *Ascarite.* Commercially available.

7. *Procedure.*

7.1 *Sampling.*

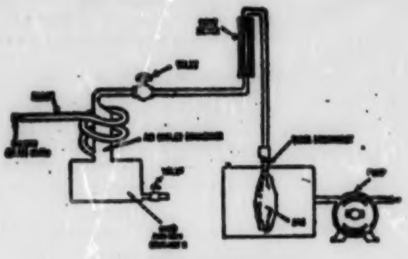

Figure 10-2. Integrated gas-sampling train.

7.1.1 *Continuous sampling.* Set up the equipment as shown in Figure 10–1 making sure all connections are leak free. Place the probe in the stack at a sampling point and purge the sampling line. Connect the analyzer and begin drawing sample into the analyzer. Allow 5 minutes for the system to stabilize, then record the analyzer reading as required by the test procedure. (See ¶ 7.2 and 8). CO_2 content of the gas may be determined by using the Method 3 integrated sample procedure (36 FR 24886), or by weighing the ascarite CO_2 removal tube and computing CO_2 concentration from the gas volume sampled and the weight gain of the tube.

7.1.2 *Integrated sampling.* Evacuate the flexible bag. Set up the equipment as shown in Figure 10–2 with the bag disconnected. Place the probe in the stack and purge the sampling line. Connect the bag, making sure that all connections are leak free. Sample at a rate proportional to the stack velocity. CO_2 content of the gas may be determined by using the Method 3 integrated sample procedures (36 FR 24886), or by weighing the ascarite CO_2 removal tube and computing CO_2 concentration from the gas volume sampled and the weight gain of the tube.

7.2 *CO Analysis.* Assemble the apparatus as shown in Figure 10–3, calibrate the instrument, and perform other required operations as described in paragraph 8. Purge analyzer with N_2 prior to introduction of each sample. Direct the sample stream through the instrument for the test period, recording the readings. Check the zero and span again after the test to assure that any drift or malfunction is detected. Record the sample data on Table 10–1.

8. *Calibration.* Assemble the apparatus according to Figure 10–3. Generally an instrument requires a warm-up period before stability is obtained. Follow the manufacturer's instructions for specific procedure. Allow a minimum time of one hour for warm-up. During this time check the sample conditioning apparatus, i.e., filter, condenser, drying tube, and CO_2 removal tube, to ensure that each component is in good operating condition. Zero and calibrate the instrument according to the manufacturer's procedures using, respectively, nitrogen and the calibration gases.

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[1] Mention of trade names or specific products does not constitute endorsement by the Environmental Protection Agency.

9. *Calculation—Concentration of carbon monoxide.* Calculate the concentration of carbon monoxide in the stack using equation 10-1.

$$C_{CO_{stack}} = C_{CO_{NDIR}}(1 - F_{CO_2}) \qquad \text{equation 10-1}$$

where:

$C_{CO_{stack}}$ = concentration of CO in stack, ppm by volume (dry basis).

${}^{c}CO_{NDIR}$ = concentration of CO measured by NDIR analyser, ppm by volume (dry basis). ^{6}

F_{CO_2} = volume fraction of CO_2 in sample, i.e., percent CO_2 from Orsat analysis divided by 100.

10. *Bibliography.*

10.1 McElroy, Frank, The Intertech NDIR-CO Analyser, Presented at 11th Methods Conference on Air Pollution, University of California, Berkeley, Calif., April 1, 1970.

10.2 Jacobs, M. B., et al., Continuous Determination of Carbon Monoxide and Hydrocarbons in Air by a Modified Infrared Analyser, J. Air Pollution Control Association, 9(2):110-114, August 1959.

10.3 MSA LIRA Infrared Gas and Liquid Analyser Instruction Book, Mine Safety Appliances Co., Technical Products Division, Pittsburgh, Pa.

10.4 Models 215A, 315A, and 415A Infrared Analysers, Beckman Instruments, Inc., Beckman Instructions 1635-B, Fullerton, Calif., October 1967.

10.5 Continuous CO Monitoring System, Model A5611, Intertech Corp., Princeton, N.J.

10.6 UNOR Infrared Gas Analysers, Bendix Corp., Ronceverte, West Virginia.

ADDENDA

A. Performance Specifications for NDIR Carbon Monoxide Analysers.

Range (minimum)	0-1000ppm.
Output (minimum)	0-10mV.
Minimum detectable sensitivity	20 ppm.
Rise time, 90 percent (maximum)	30 seconds.
Fall time, 90 percent (maximum)	30 seconds.
Zero drift (maximum)	10% in 8 hours.
Span drift (maximum)	10% in 8 hours.
Precision (minimum)	± 2% of full scale.
Noise (maximum)	± 1% of full scale.
Linearity (maximum deviation)	2% of full scale.
Interference rejection ratio	CO_2—1000 to 1, H_2O—500 to 1.

B. *Definitions of Performance Specifications.*

Range—The minimum and maximum measurement limits.

Output—Electrical signal which is proportional to the measurement; intended for connection to readout or data processing devices. Usually expressed as millivolts or milliamps full scale at a given impedance.

Full scale—The maximum measuring limit for a given range.

Minimum detectable sensitivity—The smallest amount of input concentration that can be detected as the concentration approaches zero.

Accuracy—The degree of agreement between a measured value and the true value; usually expressed as ± percent of full scale.

Time to 90 percent response—The time interval from a step change in the input concentration at the instrument inlet to a reading of 90 percent of the ultimate recorded concentration.

Rise Time (90 percent)—The interval between initial response time and time to 90 percent response after a step increase in the inlet concentration.

Fall Time (90 percent)—The interval between initial response time and time to 90 percent response after a step decrease in the inlet concentration.

Zero Drift—The change in instrument output over a stated time period, usually 24 hours, of unadjusted continuous operation when the input concentration is zero; usually expressed as percent full scale.

Span Drift—The change in instrument output over a stated time period, usually 24 hours, of unadjusted continuous operation when the input concentration is a stated upscale value; usually expressed as percent full scale.

Precision—The degree of agreement between repeated measurements of the same concentration, expressed as the average deviation of the single results from the mean.

Noise—Spontaneous deviations from a mean output not caused by input concentration changes.

Linearity—The maximum deviation between an actual instrument reading and the reading predicted by a straight line drawn between upper and lower calibration points.

METHOD 11—DETERMINATION OF HYDROGEN SULFIDE EMISSIONS FROM STATIONARY SOURCES [5]

1. *Principle and applicability.*

1.1 *Principle.* Hydrogen sulfide (H_2S) is collected from the source in a series of midget impingers and reacted with alkaline cadmium hydroxide [$Cd(OH)_2$] to form cadmium sulfide (CdS). The precipitated CdS is then dissolved in hydrochloric acid and absorbed in a known volume of iodine solution. The iodine consumed is a measure of the H_2S content of the gas. An impinger containing hydrogen peroxide is included to remove SO_2 as an interfering species.

1.2 *Applicability.* This method is applicable for the determination of hydrogen sulfide emissions from stationary sources only when specified by the test procedures for determining compliance with the new source performance standards.

2. *Apparatus.*

2.1 *Sampling train.*

2.1.1 *Sampling line*—6- to 7-mm (¼-inch) Teflon[1] tubing to connect sampling train to sampling valve, with provisions for heating to prevent condensation. A pressure reducing valve prior to the Teflon sampling line may be required depending on sampling stream pressure.

2.1.2 *Impingers*—Five midget impingers, each with 30-ml capacity, or equivalent.

2.1.3 *Ice bath container*—To maintain absorbing solution at a constant temperature.

2.1.4 *Silica gel drying tube*—To protect pump and dry gas meter.

2.1.5 *Needle valve, or equivalent*—Stainless steel or other corrosion resistant material, to adjust gas flow rate.

2.1.6 *Pump*—Leak free, diaphragm type, or equivalent, to transport gas. (Not required if sampling stream under positive pressure.)

2.1.7 *Dry gas meter*—Sufficiently accurate to measure sample volume to within 1 percent.

2.1.8 *Rate meter*—Rotameter, or equivalent, to measure a flow rate of 0 to 3 liters per minute ($0.1\ ft^3/min$).

2.1.9 *Graduated cylinder*—25 ml.

2.1.10 *Barometer*—To measure atmospheric pressure within ±2.5 mm (0.1 in.) Hg.

2.2 *Sample Recovery.*

2.2.1 *Sample container*—500-ml glass-stoppered iodine flask.

2.2.2 *Pipette*—50-ml volumetric type.

2.2.3 *Beakers*—250 ml.

2.2.4 *Wash bottle*—Glass.

2.3 *Analysis.*

2.3.1 *Flask*—500-ml glass-stoppered iodine flask.

2.3.2 *Burette*—One 50 ml.

2.3.3 *Flask*—125-ml conical.

3. *Reagents.*

3.1 *Sampling.*

3.1.1 *Absorbing solution*—Cadmium hydroxide ($Cd(OH)_2$)—Mix 4.3 g cadmium sulfate hydrate ($3\ CdSO_4 \cdot 8H_2O$) and 0.3 g of sodium hydroxide ($NaOH$) in 1 liter of distilled water (H_2O). Mix well.

Note: The cadmium hydroxide formed in this mixture will precipitate as a white suspension. Therefore, this solution must be thoroughly mixed before using to ensure an even distribution of the cadmium hydroxide.

3.1.2 *Hydrogen peroxide, 3 percent*—Dilute 30 percent hydrogen peroxide to 3 percent as needed. Prepare fresh daily.

3.2 *Sample recovery.*

3.2.1 *Hydrochloric acid solution (HCl), 10 percent by weight*—Mix 230 ml of concentrated HCl (specific gravity 1.19) and 770 ml of distilled H_2O.

3.2.2 *Iodine solution, 0.1 N*—Dissolve 24 g potassium iodide (KI) in 30 ml of distilled H_2O in a 1-liter graduated cylinder. Weigh 12.7 g of resublimed iodine (I_2) into a weighing bottle and add to the potassium iodide solution. Shake the mixture until the iodine is completely dissolved. Slowly dilute the solution to 1 liter with distilled H_2O, with swirling. Filter the solution, if cloudy, and store in a brown glass-stoppered bottle.

3.2.3 *Standard iodine solution, 0.01 N*—Dilute 100 ml of the 0.1 *N* iodine solution in a volumetric flask to 1 liter with distilled water.

Standardize daily as follows: Pipette 25 ml of the 0.01 *N* iodine solution into a 125-ml conical flask. Titrate with standard 0.01 *N* thiosulfate solution (see paragraph 3.3.2) until the solution is a light yellow. Add a few drops of the starch solution and continue titrating until the blue color just disappears. From the results of this titration, calculate the exact normality of the iodine solution (see paragraph 5.1).

3.2.4 *Distilled, deionized water.*

3.3 *Analysis.*

3.3.1 *Sodium thiosulfate solution, standard 0.1 N*—For each liter of solution, dissolve 24.8 g of sodium thiosulfate ($NA_2S_2O_3 \cdot 5H_2O$) in distilled water and add 0.01 g of anhydrous sodium carbonate (Na_2CO_3) and 0.4 ml of chloroform ($CHCl_3$) to stabilize. Mix thoroughly by shaking or by aerating with nitrogen for approximately 15 minutes, and store in a glass-stoppered glass bottle.

Standardize frequently as follows: Weigh into a 500-ml volumetric flask about 2 g of potassium dichromate ($K_2Cr_2O_7$) weighed to the nearest milligram and dilute to the 500-ml mark with distilled H_2O. Use dichromate which has been crystallized from distilled water and oven-dried at 182°C to 199°C (360°F to 390°F). Dissolve approximately 3 g of potassium iodide (KI) in 50 ml of distilled water in a glass-stoppered, 500-ml conical flask, then add 5 ml of 20-percent hydrochloric acid solution. Pipette 50 ml of the dichromate solution into this mixture. Gently swirl the solution once and allow it to stand in the dark for 5 minutes. Dilute the solution with 100 to 200 ml of distilled water, washing down the sides of the flask with part of the water. Swirl the solution slowly and titrate with the thiosulfate solution until the solution is light yellow. Add 4 ml of starch solution and continue with a slow titration with the thiosulfate until the bright blue color has disappeared and only the pale green color of the chromic ion remains. From this titration, calculate the exact normality of the sodium thiosulfate solution (see paragraph 5.2).[6]

3.3.2 *Sodium thiosulfate solution, standard 0.01 N*—Pipette 100 ml of the standard 0.1 *N* thiosulfate solution into a volumetric flask and dilute to one liter with distilled water.

3.3.3 *Starch indicator solution*—Suspend 10 g of soluble starch in 100 ml of distilled water and add 15 g of potassium hydroxide pellets. Stir until dissolved, dilute with 900 ml of distilled water, and let stand 1 hour. Neutralize the alkali with concentrated hydrochloric acid, using an indicator paper similar to Alkacid test ribbon, then add 2 ml of glacial acetic acid as a preservative.

Test for decomposition by titrating 4 ml of starch solution in 200 ml of distilled water with 0.01 *N* iodine solution. If more than 4 drops of the 0.01 *N* iodine solution are required to obtain the blue color, make up a fresh starch solution.

4. *Procedure.*

4.1 *Sampling.*

4.1.1 Assemble the sampling train as shown in Figure 11-1, connecting the five midget impingers in series. Place 15 ml of 3 percent hydrogen peroxide in the first impinger. Place 15 ml of the absorbing solution in each of the next three impingers, leaving the fifth dry. Place crushed ice around the impingers. Add more ice during the run to keep the temperature of the gases leaving the last impinger at about 20°C (70°F), or less.

4.1.2 Purge the connecting line between the sampling valve and the first impinger. Connect the sample line to the train. Record the initial reading on the dry gas meter as shown in Table 11-1.

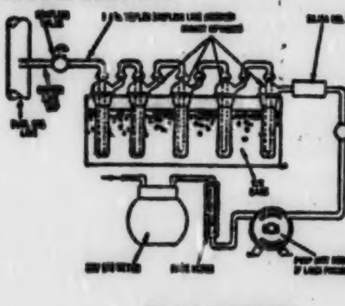

Figure 11-1. H_2S sampling train.

TABLE 11-1.—*Field data*

Location .... Comments:

Test ....

Date ....

Operator ....

Barometric pressure..

Clock time	Gas volume through meter (V_m), liters (cubic feet)	Rotameter setting, Lpm (cubic feet per minute)	Meter temperature, ° C (° F)

4.1.3 Open the flow control valve and adjust the sampling rate to 1.13 liters per minute (0.04 cfm). Read the meter temperature and record on Table 11-1.

4.1.4 Continue sampling a minimum of 10 minutes. If the yellow color of cadmium sulfide is visible in the third impinger, analysis should confirm that the applicable standard has been exceeded. At the end of the sample time, close the flow control valve and read the final meter volume and temperature.

4.1.5 Disconnect the impinger train from the sampling line. Purge the train with clean ambient air for 15 minutes to ensure that all H_2S is removed from the hydrogen peroxide. Cap the open ends and move to the sample clean-up area.

4.2 *Sample recovery.*

4.2.1 Pipette 50 ml of 0.01 *N* iodine solution into a 250-ml beaker. Add 50 ml of 10 percent HCl to the solution. Mix well.

4.2.2 Discard the contents of the hydrogen peroxide impinger. Carefully transfer the contents of the remaining four impingers to a 500-ml iodine flask.

4.2.3 Rinse the four absorbing impingers and connecting glassware with three portions of the acidified iodine solution. Use the entire 100 ml of acidified iodine for this purpose. Immediately after pouring the acidified iodine into an impinger, stopper it and shake for a few moments before transferring the rinse to the iodine flask. Do not transfer any rinse portion from one impinger to another; transfer it directly to the iodine flask. Once acidified iodine solution has been poured into any glassware containing cadmium sulfide sample, the container must be tightly stoppered at all times except when adding more solution, and this must be done as quickly and carefully as possible. After adding any acidified iodine solution to the iodine flask, allow a few minutes for absorption of the H_2S into the iodine before adding any further rinses.

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[1] Mention of trade names or specific products does not constitute endorsement by the Environmental Protection Agency.

4.2.4 Follow this rinse with two more rinses using distilled water. Add the distilled water rinses to the iodine flask. Stopper the flask and shake well. Allow about 30 minutes for absorption of the H_2S into the iodine, then complete the analysis titration.

Caution: Keep the iodine flask stoppered except when adding sample or titrant.

4.2.5 Prepare a blank in an iodine flask using 45 ml of the absorbing solution, 50 ml of 0.01 *N* iodine solution, and 50 ml of 10 percent HCl. Stopper the flask, shake well and analyze with the samples.

4.3 *Analysis.*

Note: This analysis titration should be conducted at the sampling location in order to prevent loss of iodine from the sample. Titration should never be made in direct sunlight.

4.3.1 Titrate the solution in the flask with 0.01 *N* sodium thiosulfate solution until the solution is light yellow. Add 4 ml of the starch indicator solution and continue titrating until the blue color just disappears.

4.3.2 Titrate the blanks in the same manner as the samples.

5. *Calculations.*

5.1 *Normality of the standard iodine solution.*

$$N_I = \frac{N_T V_T}{V_I} \qquad \text{equation 11-1}$$

where:

N_I = normality of iodine, g-eq/liter.
V_I = volume of iodine used, ml.
N_T = normality of sodium thiosulfate, g-eq/liter.
V_T = volume of sodium thiosulfate used, ml.

5.2 *Normality of the standard thiosulfate solution.* 6

$$N_T = 2.04 \frac{W}{V_T} \qquad \text{equation 11-2}$$

where:

W = weight of $K_2Cr_2O_7$ used, g.
V_T = volume of $Na_2S_2O_3$ used, ml.
N_T = normality of standard thiosulfate solution, g-eq/liter.
2.04 = conversion factor

$$= \frac{(6 \text{ eq } I_2/\text{mole } K_2Cr_2O_7)\ (1{,}000 \text{ ml/l})}{(294.2 \text{ g } K_2Cr_2O_7/\text{mole})\ (10 \text{ aliquot factor}).}$$

5.3 *Dry gas volume.* Correct the sample volume measured by the dry gas meter to standard conditions [21°C(70°F)] and 760 mm (29.92 inches) Hg] by using equation 11-3.

$$V_{m_{std}} = V_m \left(\frac{T_{std}}{T_m}\right) \left(\frac{P_{bar}}{P_{std}}\right) \qquad \text{equation 11-3}$$

where:

$V_{m_{std}}$ = volume at standard conditions of gas sample through the dry gas meter, standard liters (scf).
V_m = volume of gas sample through the dry gas meter (meter conditions), liters (cu. ft.).
T_{std} = absolute temperature at standard conditions, 294°K (530°R).
T_m = average dry gas meter temperature, °K (°R).
P_{bar} = barometric pressure at the orifice meter, mm Hg (in. Hg).
P_{std} = absolute pressure at standard conditions, 760 mm Hg (29.92 in. Hg).

5.4 *Concentration of H_2S.*—Calculate the concentration of H_2S in the gas stream at standard conditions using equation 11-4:

$$C_{H_2S} = \frac{K[(V_I N_I - V_T N_T)_{\text{sample}} - (V_I N_I - V_T N_T)_{\text{blank}}]}{V_{m_{std}}}$$

where (metric units):

C_{H_2S} = concentration of H_2S at standard conditions, mg/dscm
K = conversion factor = 17.0×10^3

$$= \frac{(34.07 \text{ g/mole } H_2S)(1{,}000 \text{ l}/m^3)(1{,}000 \text{ mg/g})}{(1{,}000 \text{ ml/l})(2H_2S \text{ eq/mole})}$$

V_I = volume of standard iodine solution, ml.
N_I = normality of standard iodine solution, g-eq/liter.
V_T = volume of standard sodium thiosulfate solution, ml.
N_T = normality of standard sodium thiosulfate solution, g-eq/liter.
$V_{m_{std}}$ = dry gas volume at standard conditions, liters.

where (English units): 6

$$K = 0.263 = \frac{17.0(15.43 \text{ gr/g})}{(1{,}000 \text{ l}/m^3)}$$

$V_{m_{std}}$ = scf.
C_{H_2S} = gr/dscf.

6. *References.*

6.1 Determination of Hydrogen Sulfide, Ammoniacal Cadmium Chloride Method, API Method 772-54. In: Manual on Disposal of Refinery Wastes, Vol. V: Sampling and Analysis of Waste Gases and Particulate Matter, American Petroleum Institute, Washington, D.C., 1954.

6.2 Tentative Method for Determination of Hydrogen Sulfide and Mercaptan Sulfur in Natural Gas, Natural Gas Processors Association, Tulsa, Oklahoma, NGPA Publication No. 2265-65, 1965.

METHOD 13—DETERMINATION OF TOTAL FLUORIDE EMISSIONS FROM STATIONARY SOURCES—SPADNS ZIRCONIUM LAKE METHOD 14

1. *Principle and Applicability.*

1.1 *Principle.* Gaseous and particulate fluorides are withdrawn isokinetically from the source using a sampling train. The fluorides are collected in the impinger water and on the filter of the sampling train. The weight of total fluorides in the train is determined by the SPADNS Zirconium Lake colorimetric method.

1.2 *Applicability.* This method is applicable for the determination of fluoride emissions from stationary sources only when specified by the test procedures for determining compliance with new source performance standards. Fluorocarbons, such as Freons, are not quantitatively collected or measured by this procedure.

2. *Range and Sensitivity.*

The SPADNS Zirconium Lake analytical method covers the range from 0–1.4 μg/ml fluoride. Sensitivity has not been determined.

3. *Interferences.*

During the laboratory analysis, aluminum in excess of 300 mg/liter and silicon dioxide in excess of 300 μg/liter will prevent complete recovery of fluoride. Chloride will distill over and interfere with the SPADNS Zirconium Lake color reaction. If chloride ion is present, use of Specific Ion Electrode (Method 13B) is recommended; otherwise a chloride determination is required and 5 mg of silver sulfate (see section 7.3.6) must be added for each mg of chloride to prevent chloride interference. If sulfuric acid is carried over in the distillation, it will cause a positive interference. To avoid sulfuric acid carryover, it is important to stop distillation at 175°C.

4. *Precision, Accuracy and Stability.*

4.1 *Analysis.* A relative standard deviation of 3 percent was obtained from twenty replicate intralaboratory determinations on stack emission samples with a concentration range of 39 to 360 mg/l. A phosphate rock standard which was analyzed by this procedure contained a certified value of 3.84 percent. The average of five determinations was 3.88 percent fluoride.

4.2 *Stability.* The color obtained when the sample and colorimetric reagent are mixed is stable for approximately two hours. After formation of the color, the absorbances of the sample and standard solutions should be measured at the same temperature. A 3°C temperature difference between sample and standard solutinos will produce an error of approximately 0.005 mg F/liter.

5. *Apparatus.*

5.1 *Sample train.* See Figure 13A–1; it is similar to the Method 5 train except for the interchangeability of the position of the filter. Commercial models of this train are available. However, if one desires to build his own, complete construction details are described in APTD–0581; for changes from the APTD–0581 document and for allowable modifications to Figure 13A–1, see the following subsections.

The operating and maintenance procedures for the sampling train are described in APTD–0576. Since correct usage is important in obtaining valid results, all users should read the APTD–0576 document and adopt the operating and maintenance procedures outlined in it, unless otherwise specified herein.

5.1.1 Probe nozzle—Stainless steel (316) with sharp, tapered leading edge. The angle of taper shall be ≦30° and the taper shall be on the outside to preserve a constant internal diameter. The probe nozzle shall be of the button-hook or elbow design, unless otherwise specified by the Administrator. The wall thickness of the nozzle shall be less than or equal to that of 20 gauge tubing, i.e., 0.165 cm (0.065 in.) and the distance from the tip of the nozzle to the first bend or point of disturbance shall be at least two times the outside nozzle diameter. The nozzle shall be constructed from seamless stainless steel tubing. Other configurations and construction material may be used with approval from the Administrator.

A range of sizes suitable for isokinetic sampling should be available, e.g., 0.32 cm (⅛ in.) up to 1.27 cm (½ in.) (or larger if higher volume sampling trains are used) inside diameter (ID) nozzles in increments of 0.16 cm (1/16 in.). Each nozzle shall be calibrated according to the procedures outlined in the calibration section.

5.1.2 Probe liner—Borosilicate glass or stainless steel (316). When the filter is located immediately after the probe, a probe heating system may be used to prevent filter plugging resulting from moisture condensation. The temperature in the probe shall not exceed 120 ± 14°C (248 ± 25°F).

5.1.3 Pitot tube—Type S, or other device approved by the Administrator, attached to probe to allow constant monitoring of the stack gas velocity. The face openings of the pitot tube and the probe nozzle shall be adjacent and parallel to each other, not necessarily on the same plane, during sampling. The free space between the nozzle and pitot tube shall be at least 1.9 cm (0.75 in.). The free space shall be set based on a 1.3 cm (0.5 in.) ID nozzle, which is the largest size nozzle used.

The pitot tube must also meet the criteria specified in Method 2 and be calibrated according to the procedure in the calibration section of that method.

5.1.4 Differential pressure gauge—Inclined manometer capable of measuring velocity head to within 10% of the minimum measured value. Below a differential pressure of 1.3 mm (0.05 in.) water gauge, micromanometers with sensitivities of 0.013 mm (0.0005 in.) should be used. However, micromanometers are not easily adaptable to field conditions and are not easy to use with pulsating flow. Thus, other methods or devices acceptable to the Administrator may be used when conditions warrant.

5.1.5 Filter holder—If located between the probe and first impinger, borosilicate glass with a 20 mesh stainless steel screen filter support and a silicone rubber gasket; neither a glass frit filter support nor a sintered metal filter support may be used if the filter is in front of the impingers. If located between the third and fourth impingers, borosilicate glass with a glass frit filter support and a silicone rubber gasket. Other materials of construction may be used with approval from the Administrator, e.g., if probe liner is stainless steel, then filter holder may be stainless steel. The holder design shall provide a positive seal against leakage from the outside or around the filter. 30

5.1.6 Filter heating system—When moisture condensation is a problem, any heating system capable of maintaining a temperature around the filter holder during sampling of no greater than 120±14°C (248±25°F). A temperature gauge capable of measuring temperature to within 3°C (5.4°F) shall be installed so that when the filter heater is used, the temperature around the filter holder can be regulated and monitored during sampling. Heating systems other than the one shown in APTD–0581 may be used.

5.1.7 Impingers—Four impingers connected as shown in Figure 13A–1 with ground glass (or equivalent), vacuum tight fittings. The first, third, and fourth impingers are of the Greenburg-Smith design, modified by replacing the tip with a 1¼ cm (½ in.) inside diameter glass tube extending to 1¼ cm (½ in.) from the bottom of the flask. The second impinger is of the Greensburg-Smith design with the standard tip.

5.1.8 Metering system—Vacuum gauge, leak-free pump, thermometers capable of measuring temperature to within 3°C (~5°F), dry gas meter with 2% accuracy at the required sampling rate, and related equipment, or equivalent, as required to maintain an isokinetic sampling rate and to determine sample volume. When the metering system is used in conjunction with a pitot tube, the system shall enable checks of isokinetic rates.

5.1.9 Barometer—Mercury, aneroid, or other barometers capable of measuring atmospheric pressure to within 2.5 mm Hg (0.1 in. Hg). In many cases, the barometric reading may be obtained from a nearby weather bureau station, in which case the station value shall be requested and an adjustment for elevation differences shall be applied at a rate of minus 2.5 mm Hg (0.1 in. Hg) per 30 m (100 ft) elevation increase.

5.2 *Sample recovery.*

5.2.1 Probe liner and probe nozzle brushes—Nylon bristles with stainless steel wire handles. The probe brush shall have extensions, at least as long as the probe, of stainless steel, teflon, or similarly inert material. Both brushes shall be properly sized and shaped to brush out the probe liner and nozzle.

5.2.2 Glass wash bottles—Two.

5.2.3 Sample storage containers—Wide mouth, high density polyethylene bottles, 1 liter.

5.2.4 Plastic storage containers—Air tight containers of sufficient volume to store silica gel.

5.2.5 Graduated cylinder—250 ml.

5.2.6 Funnel and rubber policeman—to aid in transfer of silica gel to container; not necessary if silica gel is weighed in the field.

5.3 *Analysis.*

5.3.1 Distillation apparatus—Glass distillation apparatus assembled as shown in Figure 13A–2.

5.3.2 Hot plate—Capable of heating to 500° C.

5.3.3 Electric muffle furnace—Capable of heating to 600° C.

5.3.4 Crucibles—Nickel, 75 to 100 ml capacity.

5.3.5 Beaker, 1500 ml.

5.3.6 Volumetric flask—50 ml.

5.3.7 Erlenmeyer flask or plastic bottle—500 ml.

5.3.8 Constant temperature bath—Capable of maintaining a constant temperature of ±1.0° C in the range of room temperature.

5.3.9 Balance—300 g capacity to measure to ±0.5 g.

5.3.10 Spectrophotometer — Instrument capable of measuring absorbance at 570 nm and providing at least a 1 cm light path.

5.3.11 Spectrophotometer cells—1 cm.

6. *Reagents*

6.1 *Sampling.*

6.1.1 Filters—Whatman No. 1 filters, or equivalent, sized to fit filter holder.

6.1.2 Silica gel—Indicating type, 6–16 mesh. If previously used, dry at 175° C (350° F) for 2 hours. New silica gel may be used as received.

6.1.3 Water—Distilled.

6.1.4 Crushed ice.

6.1.5 Stopcock grease—Acetone insoluble, heat stable silicone grease. This is not necessary if screw-on connectors with teflon sleeves, or similar, are used.

6.2 *Sample recovery.*

6.2.1 Water—Distilled from same container as 6.1.3.

6.3 *Analysis.*

6.3.1 Calcium oxide (CaO)—Certified grade containing 0.005 percent fluoride or less.

6.3.2 Phenolphthalein Indicator—0.1 percent in 1:1 ethanol-water mixture.

6.3.3 Silver sulfate (Ag_2SO_4)—ACS reagent grade, or equivalent.

6.3.4 Sodium hydroxide (NaOH)—Pellets, ACS reagent grade, or equivalent.

6.3.5 Sulfuric acid (H_2SO_4)—Concentrated, ACS reagent grade, or equivalent.

6.3.6 Filters—Whatman No. 541, or equivalent.

6.3.7 Hydrochloric acid (HCl)—Concentrated, ACS reagent grade, or equivalent.

6.3.8 Water—Distilled, from same container as 6.1.3.

6.3.9 Sodium fluoride—Standard solution. Dissolve 0.2210 g of sodium fluoride in 1 liter of distilled water. Dilute 100 ml of this solution to 1 liter with distilled water. One milliliter of the solution contains 0.01 mg of fluoride.

6.3.10 SPADNS solution—[4,5dihydroxy-3-(p-sulfophenylazo)-2,7-naphthalene - disulfonic acid trisodium salt]. Dissolve 0.960 ±.010 g of SPADNS reagent in 500 ml distilled water. This solution is stable for at least one month, if stored in a well-sealed bottle protected from sunlight.

6.3.11 Reference solution—Add 10 ml of SPADNS solution (6.3.10) to 100 ml distilled water and acidify with a solution prepared by diluting 7 ml of concentrated HCl to 10 ml with distilled water. This solution is used to set the spectrophotometer zero point and should be prepared daily.

6.3.12 SPADNS Mixed Reagent—Dissolve 0.135 ±0.005 g of zirconyl chloride octahydrate ($ZrOCl_2 \cdot 8H_2O$), in 25 ml distilled water. Add 350 ml of concentrated HCl and dilute to 500 ml with distilled water. Mix equal volumes of this solution and SPADNS solution to form a single reagent. This reagent is stable for at least two months.

7. *Procedure.*

NOTE: The fusion and distillation steps of this procedure will not be required, if it can be shown to the satisfaction of the Administrator that the samples contain only water-soluble fluorides.

7.1 *Sampling.* The sampling shall be conducted by competent personnel experienced with this test procedure.

7.1.1 Pretest preparation. All train components shall be maintained and calibrated according to the procedure described in APTD-0576, unless otherwise specified herein.

Weigh approximately 200–300 g of silica gel in air tight containers to the nearest 0.5 g. Record the total weight, both silica gel and container, on the container. More silica gel may be used but care should be taken during sampling that it is not entrained and carried out from the impinger. As an alternative, the silica gel may be weighed directly in the impinger or its sampling holder just prior to the train assembly.

7.1.2 Preliminary determinations. Select the sampling site and the minimum number of sampling points according to Method 1 or as specified by the Administrator. Determine the stack pressure, temperature, and the range of velocity heads using Method 2 and moisture content using Approximation Method 4 or its alternatives for the purpose of making isokinetic sampling rate calculations. Estimates may be used. However, final results will be based on actual measurements made during the test.

Select a nozzle size based on the range of velocity heads such that it is not necessary to change the nozzle size in order to maintain isokinetic sampling rates. During the run, do not change the nozzle size. Ensure that the differential pressure gauge is capable of measuring the minimum velocity head value to within 10%, or as specified by the Administrator.

Select a suitable probe liner and probe length such that all traverse points can be sampled. Consider sampling from opposite sides for large stacks to reduce the length of probes.

Select a total sampling time greater than or equal to the minimum total sampling time specified in the test procedures for the specific industry such that the sampling time per point is not less than 2 min. or select some greater time interval as specified by the Administrator, and such that the sample volume that will be taken will exceed the required minimum total gas sample volume specified in the test procedures for the specific industry. The latter is based on an approximate average sampling rate. Note also that the minimum total sample volume is corrected to standard conditions.

It is recommended that a half-integral or integral number of minutes be sampled at each point in order to avoid timekeeping errors.

In some circumstances, e.g. batch cycles, it may be necessary to sample for shorter times at the traverse points and to obtain smaller gas sample volumes. In these cases, the Administrator's approval must first be obtained.

7.1.3 Preparation of collection train. During preparation and assembly of the sampling train, keep all openings where contamination can occur covered until just prior to assembly or until sampling is about to begin.

Place 100 ml of water in each of the first two impingers, leave the third impinger empty, and place approximately 200–300 g or more, if necessary, of preweighed silica gel in the fourth impinger. Record the weight of the silica gel and container on the data sheet. Place the empty container in a clean place for later use in the sample recovery.

Place a filter in the filter holder. Be sure that the filter is properly centered and the gasket properly placed so as to not allow the sample gas stream to circumvent the filter. Check filter for tears after assembly is completed.

When glass liners are used, install selected nozzle using a Viton A O-ring; the Viton A O-ring is installed as a seal where the nozzle is connected to a glass liner. See APTD-0576 for details. When metal liners are used, install the nozzle as above or by a leak free direct mechanical connection. Mark the probe with heat resistant tape or by some other method to denote the proper distance into the stack or duct for each sampling point.

Unless otherwise specified by the Administrator, attach a temperature probe to the metal sheath of the sampling probe so that the sensor extends beyond the probe tip and does not touch any metal. Its position should be about 1.9 to 2.54 cm (0.75 to 1 in.) from the pitot tube and probe nozzle to avoid interference with the gas flow.

Assemble the train as shown in Figure 13A-1 with the filter between the third and fourth impingers. Alternatively, the filter may be placed between the probe and first impinger if a 20 mesh stainless steel screen is used for the filter support. A filter heating system may be used to prevent moisture condensation, but the temperature around the filter holder shall not exceed 120±14°C (248±25°F). [(Note: Whatman No. 1 filter decomposes at 150°C (300°F)).] Record filter location on the data sheet. 50

Place crushed ice around the impingers.

7.14 Leak check procedure—After the sampling train has been assembled, turn on and set (if applicable) the probe and filter heating system(s) to reach a temperature sufficient to avoid condensation in the probe. Allow time for the temperature to stabilize. Leak check the train at the sampling site by plugging the nozzle and pulling a 380 mm Hg (15 in. Hg) vacuum. A leakage rate in excess of 4% of the average sampling rate or 0.00057 m^3/min. (0.02 cfm), whichever is less, is unacceptable.

The following leak check instructions for the sampling train described in APTD-0576 and APTD-0581 may be helpful. Start the pump with by-pass valve fully open and coarse adjust valve completely closed. Partially open the coarse adjust valve and slowly close the by-pass valve until 380 mm Hg (15 in. Hg) vacuum is reached. *Do not* reverse direction of by-pass valve. This will cause water to back up into the filter holder. If 380 mm Hg (15 in. Hg) is exceeded, either leak check at this higher vacuum or end the leak check as described below and start over.

When the leak check is completed, first slowly remove the plug from the inlet to the probe or filter holder and immediately turn off the vacuum pump. This prevents the water in the impingers from being forced backward into the filter holder (if placed before the impingers) and silica gel from being entrained backward into the third impinger.

Leak checks shall be conducted as described whenever the train is disengaged, e.g. for silica gel or filter changes during the test, prior to each test run, and at the completion of each test run. If leaks are found to be in excess of the acceptable rate, the test will be considered invalid. To reduce lost time due to leakage occurrences, it is recommended that leak checks be conducted between port changes.

7.1.5 Particulate train operation—During the sampling run, an isokinetic sampling rate within 10%, or as specified by the Administrator, of true isokinetic shall be maintained.

For each run, record the data required on the example data sheet shown in Figure 13A-3. Be sure to record the initial dry gas meter reading. Record the dry gas meter readings at the beginning and end of each sampling time increment, when changes in flow rates are made, and when sampling is halted. Take other data point readings at least once at each sample point during each time increment and additional readings when significant changes (20% variation in velocity head readings) necessitate additional adjustments in flow rate. Be sure to level and zero the manometer.

Clean the portholes prior to the test run to minimize chance of sampling deposited material. To begin sampling, remove the nozzle cap, verify (if applicable) that the probe heater is working and filter heater is up to temperature, and that the pitot tube and probe are properly positioned. Position the nozzle at the first traverse point with the tip pointing directly into the gas stream. Immediately start the pump and adjust the flow to isokinetic conditions. Nomographs are available for sampling trains using type S pitot tubes with 0.85±0.02 coefficients (C_p), and when sampling in air or a stack gas with equivalent density (molecular weight, M_d, equal to 29±4), which aid in the rapid adjustment of the isokinetic sampling rate without excessive computations. APTD-0576 details the procedure for using these nomographs. If C_p and M_d are outside the above stated ranges, do not use the nomograph unless appropriate steps are taken to compensate for the deviations.

When the stack is under significant negative pressure (height of impinger stem), take care to close the coarse adjust valve before inserting the probe into the stack to avoid water backing into the filter holder. If necessary, the pump may be turned on with the coarse adjust valve closed.

When the probe is in position, block off the openings around the probe and porthole to prevent unrepresentative dilution of the gas stream.

Traverse the stack cross section, as required by Method 1 or as specified by the Administrator, being careful not to bump the probe nozzle into the stack walls when sampling near the walls or when removing or inserting the probe through the portholes to minimize chance of extracting deposited material.

During the test run, make periodic adjustments to keep the probe and (if applicable) filter temperatures at their proper values. Add more ice and, if necessary, salt to the ice bath, to maintain a temperature of less than 20°C (68°F) at the impinger/silica gel outlet, to avoid excessive moisture losses. Also, periodically check the level and zero of the manometer.

If the pressure drop across the filter becomes high enough to make isokinetic sampling difficult to maintain, the filter may be replaced in the midst of a sample run. It is recommended that another complete filter assembly be used rather than attempting to change the filter itself. After the new filter or filter assembly is installed conduct a leak check. The final emission results shall be based on the summation of all filter catches.

A single train shall be used for the entire sample run, except for filter and silica gel changes. However, if approved by the Administrator, two or more trains may be used for a single test run when there are two or more ducts or sampling ports. The final emission results shall be based on the total of all sampling train catches.

At the end of the sample run, turn off the pump, remove the probe and nozzle from the stack, and record the final dry gas meter reading. Perform a leak check.[1] Calculate percent isokinetic (see calculation section) to determine whether another test run should be made. If there is difficulty in maintaining isokinetic rates due to source conditions, consult with the Administrator for possible variance on the isokinetic rates.

7.2 Sample recovery. Proper cleanup procedure begins as soon as the probe is removed from the stack at the end of the sampling period.

When the probe can be safely handled, wipe off all external particulate matter near the tip of the probe nozzle and place a cap over it to keep from losing part of the sample. Do not cap off the probe tip tightly while the sampling train is cooling down, as this would create a vacuum in the filter holder, thus drawing water from the impingers into the filter.

Before moving the sample train to the cleanup site, remove the probe from the sample train, wipe off the silicone grease, and cap the open outlet of the probe. Be careful not to lose any condensate, if present. Wipe off the silicone grease from the filter inlet where the probe was fastened and cap it. Remove the umbilical cord from the last impinger and cap the impinger. After wiping off the silicone grease, cap off the filter holder outlet and impinger inlet. Ground glass stoppers, plastic caps, or serum caps may be used to close these openings.

Transfer the probe and filter-impinger assembly to the cleanup area. This area should be clean and protected from the wind so that the chances of contaminating or losing the sample will be minimized.

Inspect the train prior to and during disassembly and note any abnormal conditions. Using a graduated cylinder, measure and record the volume of the water in the first three impingers, to the nearest ml; any condensate in the probe should be included in this determination. Treat the samples as follows:

7.2.1 Container No. 1. Transfer the impinger water from the graduated cylinder to this container. Add the filter to this container. Wash all sample exposed surfaces, including the probe tip, probe, first three impingers, impinger connectors, filter holder, and graduated cylinder thoroughly with distilled water. Wash each component three separate times with water and clean the probe and nozzle with brushes. A maximum wash of 500 ml is used, and the washings are added to the sample container which must be made of polyethylene.

7.2.2 Container No. 2. Transfer the silica gel from the fourth impinger to this container and seal.

7.3 *Analysis*. Treat the contents of each sample container as described below.

7.3.1 Container No. 1.

7.3.1.1 Filter this container's contents, including the Whatman No. 1 filter, through Whatman No. 541 filter paper, or equivalent into a 1500 ml beaker. Note: If filtrate volume exceeds 900 ml make filtrate basic with NaOH to phenolphthalein and evaporate to less than 900 ml.

7.3.1.2 Place the Whatman No. 541 filter containing the insoluble matter (including the Whatman No. 1 filter) in a nickel crucible, add a few ml of water and macerate the filter with a glass rod.

Add 100 mg CaO to the crucible and mix the contents thoroughly to form a slurry. Add a couple of drops of phenolphthalein indicator. The indicator will turn red in a basic medium. The slurry should remain basic during the evaporation of the water or fluoride ion will be lost. If the indicator turns colorless during the evaporation, an acidic condition is indicated. If this happens add CaO until the color turns red again.

Place the crucible in a hood under infrared lamps or on a hot plate at low heat. Evaporate the water completely.

After evaporation of the water, place the crucible on a hot plate under a hood and slowly increase the temperature until the paper chars. It may take several hours for complete charring of the filter to occur.

Place the crucible in a cold muffle furnace and gradually (to prevent smoking) increase the temperature to 600°C, and maintain until the contents are reduced to an ash. Remove the crucible from the furnace and allow it to cool.

7.3.1.3 Add approximately 4 g of crushed NaOH to the crucible and mix. Return the crucible to the muffle furnace, and fuse the sample for 10 minutes at 600°C.

Remove the sample from the furnace and cool to ambient temperature. Using several rinsings of warm distilled water transfer the contents of the crucible to the beaker containing the filtrate from container No. 1 (7.3.1). To assure complete sample removal, rinse finally with two 20 ml portions of 25 percent (v/v) sulfuric acid and carefully add to the beaker. Mix well and transfer a one-liter volumetric flask. Dilute to volume with distilled water and mix thoroughly. Allow any undissolved solids to settle.

7.3.2 Container No. 2. Weigh the spent silica gel and report to the nearest 0.5 g.

7.3.3 Adjustment of acid/water ratio in distillation flask—(Utilize a protective shield when carrying out this procedure.) Place 400 ml of distilled water in the distilling flask and add 200 ml of concentrated H_2SO_4. Caution: Observe standard precautions when mixing the H_2SO_4 by slowly adding the acid to the flask with constant swirling. Add some soft glass beads and several small pieces of broken glass tubing and assemble the apparatus as shown in Figure 13A-2. Heat the flask until it reaches a temperature of 175°C to adjust the acid/water ratio for subsequent distillations. Discard the distillate.

7.3.4 Distillation—Cool the contents of the distillation flask to below 80°C. Pipette an aliquot of sample containing less than 0.6 mg F directly into the distilling flask and add distilled water to make a total volume of 220 ml added to the distilling flask. [For an estimate of what size aliquot does not exceed 0.6 mg F, select an aliquot of the solution and treat as described in Section 7.3.5. This will give an approximation of the fluoride content, but only an approximation since interfering ions have not been removed by the distillation step.] 50

Place a 250 ml volumetric flask at the condenser exit. Now begin distillation and gradually increase the heat and collect all the distillation up to 175°C. Caution: Heating the solution above 175°C will cause sulfuric acid to distill over.

The acid in the distilling flask can be used until there is carryover of interferences or poor fluoride recovery. An occasional check of fluoride recovery with standard solutions is advised. The acid should be changed whenever there is less than 90 percent recovery or blank values are higher than 0.1 μg/ml. Note: If the sample contains chloride, add 5 mg Ag_2SO_4 to the flask for every mg of chloride. Gradually increase the heat and collect all the distillate up to 175°C. Do not exceed 175°C.

7.3.5 Determination of Concentration—Bring the distillate in the 250 ml volumetric flask to the mark with distilled water and mix thoroughly. Pipette a suitable aliquot from the distillate (containing 10 μg to 40 μg fluoride) and dilute to 50 ml with distilled water. Add 10 ml of SPADNS Mixed Reagent (see Section 6.3.12) and mix thoroughly.

After mixing, place the sample in a constant temperature bath containing the standard solution for thirty minutes before reading the absorbance with the spectrophotometer.

Set the spectrophotometer to zero absorbance at 570 nm with reference solution (6.3.11), and check the spectrophotometer calibration with the standard solution. Determine the absorbance of the samples and determine the concentration from the calibration curve. If the concentration does not fall within the range of the calibration curve, repeat the procedure using a different size aliquot.

8. *Calibration*.

Maintain a laboratory log of all calibrations.

8.1 Sampling Train.

8.1.1 Probe nozzle—Using a micrometer, measure the inside diameter of the nozzle to the nearest 0.025 mm (0.001 in.). Make 3 separate measurements using different diameters each time and obtain the average of the measurements. The difference between the high and low numbers shall not exceed 0.1 mm (0.004 in.).

When nozzles become nicked, dented, or corroded, they shall be reshaped, sharpened, and recalibrated before use.

Each nozzle shall be permanently and uniquely identified.

8.1.2 Pitot tube—The pitot tube shall be calibrated according to the procedure outlined in Method 2.

8.1.3 Dry gas meter and orifice meter. Both meters shall be calibrated according to the procedure outlined in APTD-0576. When diaphragm pumps with by-pass valves are used, check for proper metering system design by calibrating the dry gas meter at an additional flow rate of 0.0057 m^3/min. (0.2 cfm) with the by-pass valve fully opened and then with it fully closed. If there is more than ±2 percent difference in flow rates when compared to the fully closed position of the by-pass valve, the system is not designed properly and must be corrected.

8.1.4 Probe heater calibration—The probe heating system shall be calibrated according to the procedure contained in APTD-0576. Probes constructed according to APTD-0581 need not be calibrated if the calibration curves in APTD-0576 are used.

8.1.5 Temperature gauges—Calibrate dial and liquid filled bulb thermometers against mercury-in-glass thermometers. Thermocouples need not be calibrated. For other devices, check with the Administrator.

8.2 Analytical Apparatus. Spectrophotometer. Prepare the blank standard by adding 10 ml of SPADNS mixed reagent to 50 my of distilled water. Accurately prepare a series of standards from the standard fluoride solution (see Section 6.3.9) by diluting 2, 4, 6, 8, 10, 12, and 14 ml volumes to 100 ml with distilled water. Pipette 50 ml from each solution and transfer to a 100 ml beaker. Then add 10 ml of SPADNS mixed reagent to each. These standards will contain 0, 10, 20, 30, 40, 50, 60, and 70 μg of fluoride (0—1.4 μg/ml) respectively.

After mixing, place the reference standards and reference solution in a constant temperature bath for thirty minutes before reading the absorbance with the spectrophotometer. All samples should be adjusted to this same temperature before analyzing. Since a 2°C temperature difference between samples and standards will produce an error of approximately 0.005 mg F/liter, care must be taken to see that samples and standards are at nearly identical temperatures when absorbances are recorded.

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[1] With acceptability of the test run to be based on the same criterion as in 7.1.4.

With the spectrophotometer at 570 nm, use the reference solution (see section 6.2.11) to set the absorbance to zero.

Determine the absorbance of the standards. Prepare a calibration curve by plotting µg F/50 ml versus absorbance on linear graph paper. A standard curve should be prepared initially and thereafter whenever the SPADNS mixed reagent is newly made. Also, a calibration standard should be run with each set of samples and if it differs from the calibration curve by ±2 percent, a new standard curve should be prepared.

9. *Calculations.*

Carry out calculations, retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after final calculation.

9.1 Nomenclature.

A_d=Aliquot of distillate taken for color development, ml.

A_n=Cross sectional area of nozzle, m² (ft²).

A_t=Aliquot of total sample added to still, ml.

B_{ws}=Water vapor in the gas stream, proportion by volume.

C_s=Concentration of fluoride in stack gas, mg/m³, corrected to standard conditions of 20° C, 760 mm Hg (68° F, 29.92 in. Hg) on dry basis.

F_t=Total weight of fluoride in sample, mg.

μgF=Concentration from the calibration curve, µg.

I=Percent of isokinetic sampling.

m_n=Total amount of particulate matter collected, mg.

M_w=Molecular weight of water, 18 g/g-mole (18 lb/lb-mole).

m_a=Mass of residue of acetone after evaporation, mg.

P_{bar}=Barometric pressure at the sampling site, mm Hg (in. Hg).

P_s=Absolute stack gas pressure, mm Hg (in. Hg).

P_{std}=Standard absolute pressure, 730 mm Hg (29.92 in. Hg).

R=Ideal gas constant, 0.06236 mm Hg-m³/°K-g-mole (21.83 in. Hg-ft³/°R-lb-mole).

T_m=Absolute average dry gas meter temperature (see fig. 13A-3), °K (°R).

T_s=Absolute average stack gas temperature (see fig. 13A-3), °K (°R).

T_{std}=Standard absolute temperature, 293° K (528° R).

V_a=Volume of acetone blank, ml.

V_{aw}=Volume of acetone used in wash, ml.

V_d=Volume of distillate collected, ml.

V_{lc}=Total volume of liquid collected in impingers and silica gel, ml. Volume of water in silica gel equals silica gel weight increase in grams times 1 ml/gram. Volume of liquid collected in impinger equals final volume minus initial volume.

V_m=Volume of gas sample as measured by dry gas meter, dcm (dcf).

$V_{m(std)}$=Volume of gas sample measured by the dry gas meter corrected to standard conditions, dscm (dscf).

$V_{w(std)}$=Volume of water vapor in the gas sample corrected to standard conditions, scm (scf).

V_t=Total volume of sample, ml.

v_s=Stack gas velocity, calculated by Method 2, Equation 2-7 using data obtained from Method 5, m/sec (ft/sec).

W_a=Weight of residue in acetone wash, mg.

ΔH=Average pressure differential across the orifice (see fig. 13A-3), meter, mm H₂O (in. H₂O).

ρ_a=Density of acetone, mg/ml (see label on bottle).

ρ_w=Density of water, 1 g/ml (0.00220 lb/ml).

θ=Total sampling time, min.

13.6=Specific gravity of mercury.

60=Sec/min.

100=Conversion to percent.

9.2 Average dry gas meter temperature and average orifice pressure drop. See data sheet (fig. 13A-3).

9.3 Dry gas volume. Correct the sample volume measured by the dry gas meter to standard conditions [20° C, 760 mm Hg (68° F, 29.92 inches Hg)] by using equation 13A-1.

$$V_{m(std)}=V_m\frac{T_{std}}{T_m}\left[\frac{P_{bar}+\frac{\Delta H}{13.6}}{P_{std}}\right]=KV_m\frac{P_{bar}+\Delta H/13.6}{T_m}$$

equation 13A-1

where:

K=0.3858 °K/mm Hg for metric units.
=17.65 °R/in. Hg for English units.

9.4 Volume of water vapor.

$$V_{w(std)}=V_{lc}\frac{\rho_w}{M_w}\frac{RT_{std}}{P_{std}}=KV_{lc}$$

equation 13A-2

where:

K=0.00134 m³/ml for metric units.
=0.0472 ft³/ml for English units.

9.5 Moisture content.

$$B_{ws}=\frac{V_{w(std)}}{V_{m(std)}+V_{w(std)}}$$

equation 13A-3

If the liquid droplets are present in the gas stream assume the stream to be saturated and use a psychrometric chart to obtain an approximation of the moisture percentage.

9.6 Concentration.

9.6.1 Calculate the amount of fluoride in the sample according to Equation 13A-4.

$$F_t=K\frac{V_t}{A_t}\frac{V_d}{A_d}(\mu g\ F)$$

equation 13A-4

where:

$K=10^{-3}$ mg/µg.

9.6.2 Concentration of fluoride in stack gas. Determine the concentration of fluoride in the stack gas according to Equation 13A-5.

$$C_s=K\frac{F_t}{V_{m(std)}}$$

equation 13A-5

where:

K=35.31 ft³/m³.

9.7 Isokinetic variation.

9.7.1 Calculations from raw data.

$$I=\frac{100\ T_s[KV_{lc}+(V_m/T_m)(P_{bar}+\Delta H/13.6)]}{60\ \theta v_s P_s A_n}$$

equation 13A-6

where:

K=0.00346 mm Hg-m³/ml-°K for metric units.
=0.00267 in. Hg-ft³/ml-°R for English units.

9.7.2 Calculations from intermediate values.

$$I=\frac{T_s V_{m(std)} P_{std}\ 100}{T_{std} v_s \theta A_n P_s\ 60\ (1-B_{ws})}$$

$$=K\frac{T_s V_{m(std)}}{P_s v_s A_n \theta\ (1-B_{ws})}$$

equation 13A-7

where:

K=4.323 for metric units.
=0.0944 for English units.

9.8 Acceptable results. The following range sets the limit on acceptable isokinetic sampling results:

If 90 percent <I< 110 percent, the results are acceptable. If the results are low in comparison to the standards and I is beyond the acceptable range, the Administrator may option to accept the results. Use reference 7.4 to make judgments. Otherwise, reject the results and repeat the test.

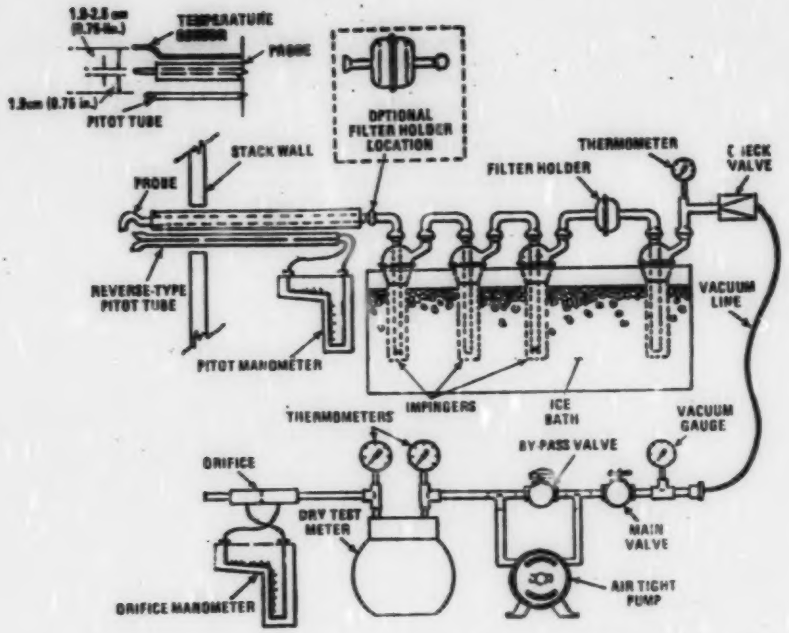
1.9-2.5 cm (0.75 in.)
TEMPERATURE SENSOR
PROBE
1.9cm (0.75 in.)
PITOT TUBE
OPTIONAL FILTER HOLDER LOCATION
STACK WALL
PROBE
THERMOMETER
CHECK VALVE
FILTER HOLDER
REVERSE-TYPE PITOT TUBE
VACUUM LINE
PITOT MANOMETER
IMPINGERS
ICE BATH
THERMOMETERS
VACUUM GAUGE
BY-PASS VALVE
ORIFICE
DRY TEST METER
MAIN VALVE
AIR TIGHT PUMP
ORIFICE MANOMETER

Figure 13A-1. Fluoride sampling train.

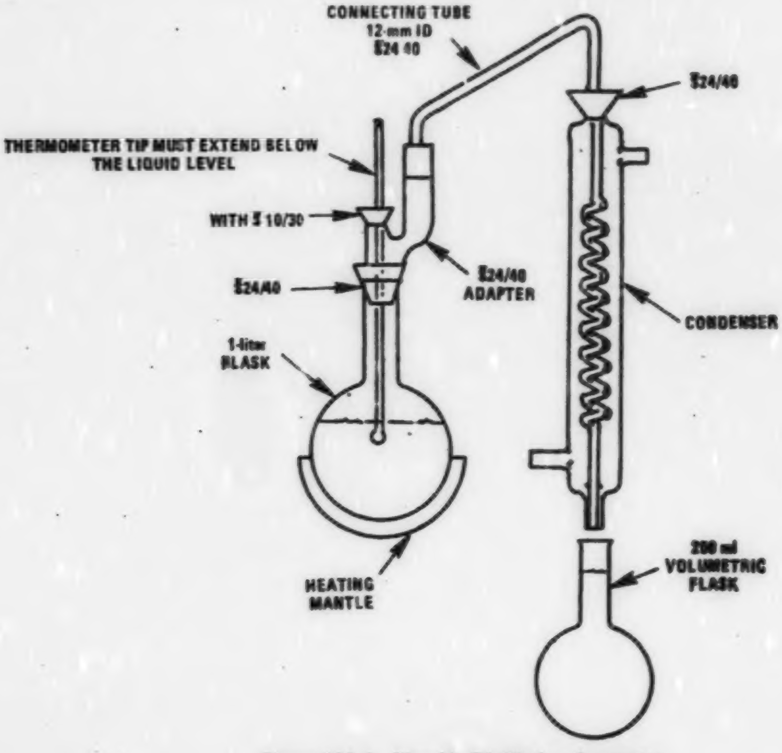
CONNECTING TUBE 12-mm ID §24/40
§24/40
THERMOMETER TIP MUST EXTEND BELOW THE LIQUID LEVEL
WITH § 10/30
§24/40
§24/40 ADAPTER
CONDENSER
1-liter FLASK
HEATING MANTLE
200 ml VOLUMETRIC FLASK

Figure 13A-2. Fluoride Distillation Apparatus

10. *References.*

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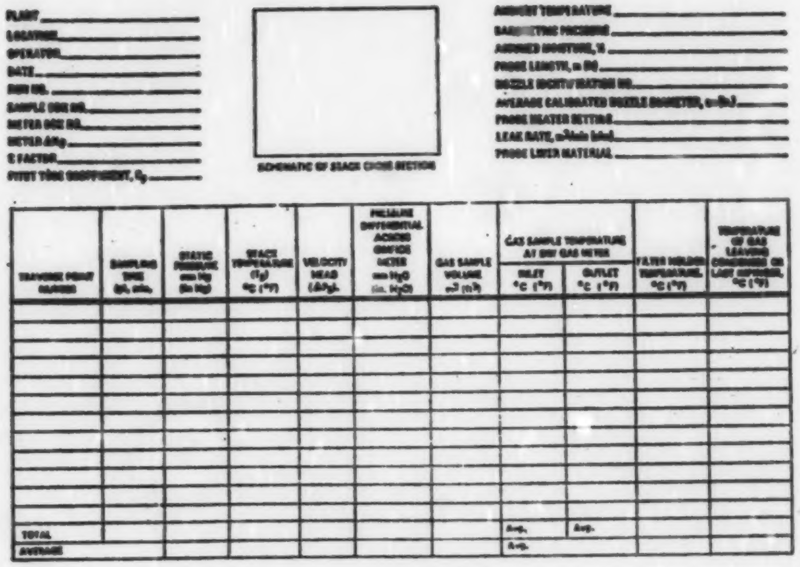
1973 Annual Book of ASTM Standards, Part 23, Designation: D 1179–72.

Rom, Jerome J., "Maintenance, Calibration, and Operation of Isokinetic Source Sampling Equipment," Environmental Protection Agency, Air Pollution Control Office Publication No. APTD-0576.

Standard Methods for the Examination of Water and Waste Water, published jointly by American Public Health Association, American Water Works Association and Water Pollution Control Federation, 13th Edition (1971).



PLANT________
LOCATION________
OPERATOR________
DATE________
RUN NO.________
SAMPLE BOX NO.________
METER BOX NO.________
METER ΔH@________
C FACTOR________
PITOT TUBE COEFFICIENT, C_p________

SCHEMATIC OF STACK CROSS SECTION

AMBIENT TEMPERATURE________
BAROMETRIC PRESSURE________
ASSUMED MOISTURE, %________
PROBE LENGTH, m (ft)________
NOZZLE IDENTIFICATION NO.________
AVERAGE CALIBRATED NOZZLE DIAMETER, cm (in.)________
PROBE HEATER SETTING________
LEAK RATE, m^3/min (cfm)________
PROBE LINER MATERIAL________

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min.	STATIC PRESSURE mm Hg (in. Hg)	STACK TEMPERATURE (T_S) °C (°F)	VELOCITY HEAD (ΔP_S)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER mm H_2O (in. H_2O)	GAS SAMPLE VOLUME m^3 (ft^3)	GAS SAMPLE TEMPERATURE AT DRY GAS METER		FILTER HOLDER TEMPERATURE, °C (°F)	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER, °C (°F)
							INLET °C (°F)	OUTLET °C (°F)		
TOTAL							Avg.	Avg.		
AVERAGE							Avg.			

Figure 13A-3. Field data.

METHOD 13B—DETERMINATION OF TOTAL FLUORIDE EMISSIONS FROM STATIONARY SOURCES—SPECIFIC ION ELECTRODE METHOD.[14]

1. *Principle and Applicability.*

1.1 Principle. Gaseous and particulate fluorides are withdrawn isokinetically from the source using a sampling train. The fluorides are collected in the impinger water and on the filter of the sampling train. The weight of total fluorides in the train is determined by the specific ion electrode method.

1.2 Applicability. This method is applicable for the determination of fluoride emissions from stationary sources only when specified by the test procedures for determining compliance with new source performance standards. Fluorocarbons such as Freons, are not quantitatively collected or measured by this procedure.

2. *Range and Sensitivity.*

The fluoride specific ion electrode analytical method covers the range of 0.02–2,000 μg F/ml; however, measurements of less than 0.1 μg F/ml require extra care. Sensitivity has not been determined.

3. *Interferences.*

During the laboratory analysis, aluminum in excess of 300 mg/liter and silicon dioxide in excess of 300 μg/liter will prevent complete recovery of fluoride.

4. *Precision, Accuracy and Stability.*

The accuracy of fluoride electrode measurements has been reported by various researchers to be in the range of 1–5 percent in a concentration range of 0.04 to 80 mg/l. A change in the temperature of the sample will change the electrode response; a change of 1°C will produce a 1.5 percent relative error in the measurement. Lack of stability in the electrometer used to measure EMF can introduce error. An error of 1 millivolt in the EMF measurement produces a relative error of 4 percent regardless of the absolute concentration being measured.

5. *Apparatus.*

5.1 Sample train. See Figure 13A–1 (Method 13A); it is similar to the Method 5 train except for the interchangeability of the position of the filter. Commercial models of this train are available. However, if one desires to build his own, complete construction details are described in APTD–0581; for changes from the APTD–0581 document and for allowable modifications to Figure 13A–1, see the following subsections.

The operating and maintenance procedures for the sampling train are described in APTD–0576. Since correct usage is important in obtaining valid results, all users should read the APTD–0576 document and adopt the operating and maintenance procedures outlined in it, unless otherwise specified herein.

5.1.1 Probe nozzle—Stainless steel (316) with sharp, tapered leading edge. The angle of taper shall be ≦30° and the taper shall be on the outside to preserve a constant internal diameter. The probe nozzle shall be of the button-hook or elbow design, unless otherwise specified by the Administrator. The wall thickness of the nozzle shall be less than or equal to that of 20 gauge tubing, i.e., 0.165 cm (0.065 in.) and the distance from the tip of the nozzle to the first bend or point of disturbance shall be at least two times the outside nozzle diameter. The nozzle shall be constructed from seamless stainless steel tubing. Other configurations and construction material may be used with approval from the Administrator.

A range of sizes suitable for isokinetic sampling should be available, e.g., 0.32 cm (⅛ in.) up to 1.27 cm (½ in.) (or larger if higher volume sampling trains are used) inside diameter (ID) nozzles in increments of 0.16 cm (1/16 in.). Each nozzle shall be calibrated according to the procedures outlined in the calibration section.

5.1.2 Probe liner—Borosilicate glass or stainless steel (316). When the filter is located immediately after the probe, a probe heating system may be used to prevent filter plugging resulting from moisture condensation. The temperature in the probe shall not exceed 120±14°C (248±25°F).

5.1.3 Pitot tube—Type S, or other device approved by the Administrator, attached to probe to allow constant monitoring of the stack gas velocity. The face openings of the pitot tube and the probe nozzle shall be adjacent and parallel to each other, not necessarily on the same plane, during sampling. The free space between the nozzle and pitot tube shall be at least 1.9 cm (0.75 in.). The free space shall be set based on a 1.3 cm (0.5 in.) ID nozzle, which is the largest size nozzle used.

The pitot tube must also meet the criteria specified in Method 2 and be calibrated according to the procedure in the calibration section of that method.

5.1.4 Differential pressure gauge—Inclined manometer capable of measuring velocity head to within 10 percent of the minimum measured value. Below a differential pressure of 1.3 mm (0.05 in.) water gauge, micromanometers with sensitivities of 0.013 mm (0.0005 in.) should be used. However, micromanometers are not easily adaptable to field conditions and are not easy to use with pulsating flow. Thus, other methods or devices acceptable to the Administrator may be used when conditions warrant.

5.1.5 Filter holder—If located between the probe and first impinger, borosilicate glass with a 20 mesh stainless steel screen filter support and a silicone rubber gasket; neither a glass frit filter support nor a sintered metal filter support may be used if the filter is in front of the impingers. If located between the third and fourth impingers, borosilicate glass with a glass frit filter support and a silicone rubber gasket. Other materials of construction may be used with approval from the Administrator, e.g., if probe liner is stainless steel, then filter holder may be stainless steel. The holder design shall provide a positive seal against leakage from the outside or around the filter.[30]

5.1.6 Filter heating system—When moisture condensation is a problem, any heating system capable of maintaining a temperature around the filter holder during sampling of no greater than 120 ± 14°C (248 ± 25°F). A temperature gauge capable of measuring temperature to within 3°C (5.4°F) shall be installed so that when the filter heater is used, the temperature around the filter holder can be regulated and monitored during sampling. Heating systems other than the one shown in APTD–0581 may be used.

5.1.7 Impingers—Four impingers connected as shown in Figure 13A–1 with ground glass (or equivalent), vacuum tight fittings. The first, third, and fourth impingers are of the Greenburg-Smith design, modified by replacing the tip with a 1¼ cm (½ in.) inside diameter glass tube extending to 1¼ cm (½ in.) from the bottom of the flask. The second impinger is of the Greenburg-Smith design with the standard tip.

5.1.8 Metering system—Vacuum gauge, leak-free pump, thermometers capable of measuring temperature to within 3°C (~5°F), dry gas meter with 2 percent accuracy at the required sampling rate, and related equipment, or equivalent, as required to maintain an isokinetic sampling rate and to determine sample volume. When the metering system is used in conjunction with a pitot tube, the system shall enable checks of isokinetic rates.

5.1.9 Barometer—Mercury, aneroid, or other barometers capable of measuring atmospheric pressure to within 2.5 mm Hg (0.1 in Hg). In many cases, the barometric reading may be obtained from a nearby weather bureau station, in which case the station value shall be requested and an adjustment for elevation differences shall be applied at a rate of minus 2.5 mm Hg (0.1 in. Hg) per 30 m (100 ft) elevation increase.

5.2 Sample recovery.

5.2.1 Probe liner and probe nozzle brushes—Nylon bristles with stainless steel wire handles. The probe brush shall have extensions, at least as long as the probe, of stainless steel, teflon, or similarly inert material. Both brushes shall be properly sized and shaped to brush out the probe liner and nozzle.

5.2.2 Glass wash bottles—Two.

5.2.3 Sample storage containers—Wide mouth, high density polyethylene bottles, 1 liter.

5.2.4 Plastic storage containers—Air tight containers of sufficient volume to store silica gel.

5.2.5 Graduated cylinder—250 ml.

5.2.6 Funnel and rubber policeman—To aid in transfer of silica gel to container; not necessary if silica gel is weighed in the field.

5.3 Analysis.

5.3.1 Distillation apparatus—Glass distillation apparatus assembled as shown in Figure 13A–2 (Method 13A).

5.3.2 Hot plate—Capable of heating to 500°C.

5.3.3 Electric muffle furnace—Capable of heating to 600°C.

5.3.4 Crucibles—Nickel, 75 to 100 ml capacity.

5.3.5 Beaker—1500 ml.

5.3.6 Volumetric flask—50 ml.

5.3.7 Erlenmeyer flask or plastic bottle—500 ml.

5.3.8 Constant temperature bath—Capable of maintaining a constant temperature of ±1.0°C in the range of room temperature.

5.3.9 Trip balance—300 g capacity to measure to ±0.5 g.

5.3.10 Fluoride ion activity sensing electrode.

5.3.11 Reference electrode—Single junction; sleeve type. (A combination-type electrode having the references electrode and the fluoride-ion sensing electrode built into one unit may also be used).

5.3.12 Electrometer—A pH meter with millivolt scale capable of ±0.1 mv resolution, or a specific ion meter made specifically for specific ion use.

5.3.13 Magnetic stirrer and TFE fluorocarbon coated stripping bars.

6. *Reagents.*

6.1 Sampling.

6.1.1 Filters—Whatman No. 1 filters, or equivalent, sized to fit filter holder.

6.1.2 Silica gel—Indicating type, 6–16 mesh. If previously used, dry at 175°C (350°F) for 2 hours. New silica gel may be used as received.

6.1.3 Water—Distilled.

6.1.4 Crushed ice.

6.1.5 Stopcock grease—Acetone insoluble, heat stable silicone grease. This is not necessary if screw-on connectors with teflon sleeves, or similar, are used.

6.2 Sample recovery.

6.2.1 Water—Distilled from same container as 6.1.3.

6.3 Analysis.

6.3.1 Calcium oxide (CaO)—Certified grade containing 0.005 percent fluoride or less.

6.3.2 Phenolphthalein Indicator—0.1 percent in 1:1 ethanol water mixture.

6.3.3 Sodium hydroxide (NaOH)—Pellets, ACS reagent grade or equivalent.

6.3.4 Sulfuric acid (H_2SO_4)—Concentrated, ACS reagent grade or equivalent.

6.3.5 Filters—Whatman No. 541, or equivalent.

6.3.6 Water—Distilled, from same container as 6.1.3.

6.3.7 Total Ionic Strength Adjustment Buffer (TISAB)—Place approximately 500 ml of distilled water in a 1-liter beaker. Add 57 ml glacial acetic acid, 58 g sodium chloride, and 4 g CDTA (Cyclohexylene dinitrilo tetraacetic acid). Stir to dissolve. Place the beaker in a water bath to cool it. Slowly add 5 M NaOH to the solution, measuring the pH continuously with a calibrated pH/reference electrode pair, until the pH is 5.3. Cool to room temperature. Pour into a 1-liter flask and dilute to volume with distilled water. Commercially prepared TISAB buffer may be substituted for the above.

6.3.3 Fluoride Standard Solution—0.1 M fluoride reference solution. Add 4.20 grams of reagent grade sodium fluoride (NaF) to a 1-liter volumetric flask and add enough distilled water to dissolve. Dilute to volume with distilled water.

7. *Procedure.*

NOTE: The fusion and distillation steps of this procedure will not be required, if it can be shown to the satisfaction of the Administrator that the samples contain only water-soluble fluorides.

7.1 Sampling. The sampling shall be conducted by competent personnel experienced with this test procedure.

7.1.1 Pretest preparation. All train components shall be maintained and calibrated according to the procedure described in APTD-0576, unless otherwise specified herein.

Weigh approximately 200–300 g of silica gel in air tight containers to the nearest 0.5 g. Record the total weight, both silica gel and container, on the container. More silica gel may be used but care should be taken during sampling that it is not entrained and carried out from the impinger. As an alternative, the silica gel may be weighed directly in the impinger or its sampling holder just prior to the train assembly.

7.1.2 Preliminary determinations. Select the sampling site and the minimum number of sampling points according to Method 1 or as specified by the Administrator. Determine the stack pressure, temperature, and the range of velocity heads using Method 2 and moisture content using Approximation Method 4 or its alternatives for the purpose of making isokinetic sampling rate calculations. Estimates may be used. However, final results will be based on actual measurements made during the test.

Select a nozzle size based on the range of velocity heads such that it is not necessary to change the nozzle size in order to maintain isokinetic sampling rates. During the run, do not change the nozzle size. Ensure that the differential pressure gauge is capable of measuring the minimum velocity head value to within 10 percent, or as specified by the Administrator.

Select a suitable probe liner and probe length such that all traverse points can be sampled. Consider sampling from opposite sides for large stacks to reduce the length of probes.

Select a total sampling time greater than or equal to the minimum total sampling time specified in the test procedures for the specific industry such that the sampling time per point is not less than 2 min. or select some greater time interval as specified by the Administrator, and such that the sample volume that will be taken will exceed the required minimum total gas sample volume specified in the test procedures for the specific industry. The latter is based on an approximate average sampling rate. Note also that the minimum total sample volume is corrected to standard conditions.

It is recommended that a half-integral or integral number of minutes be sampled at each point in order to avoid timekeeping errors.

In some circumstances, e.g. batch cycles, it may be necessary to sample for shorter times at the traverse points and to obtain smaller gas sample volumes. In these cases, the Administrator's approval must first be obtained.

7.13 Preparation of collection train. During preparation and assembly of the sampling train, keep all openings where contamination can occur covered until just prior to assembly or until sampling is about to begin.

Place 100 ml of water in each of the first two impingers, leave the third impinger empty, and place approximately 200–300 g or more, if necessary, of preweighed silica gel in the fourth impinger. Record the weight of the silica gel and container on the data sheet. Place the empty container in a clean place for later use in the sample recovery.

Place a filter in the filter holder. Be sure that the filter is properly centered and the gasket properly placed so as to not allow the sample gas stream to circumvent the filter. Check filter for tears after assembly is completed.

When glass liners are used, install selected nozzle using a Viton A O-ring; the Viton A O-ring is installed as a seal where the nozzle is connected to a glass liner. See APTD-0576 for details. When metal liners are used, install the nozzle as above or by a leak free direct mechanical connection. Mark the probe with heat resistant tape or by some other method to denote the proper distance into the stack or duct for each sampling point.

Unless otherwise specified by the Administrator, attach a temperature probe to the metal sheath of the sampling probe so that the sensor extends beyond the probe tip and does not touch any metal. Its position should be about 1.9 to 2.54 cm (0.75 to 1 in.) from the pitot tube and probe nozzle to avoid interference with the gas flow.

Assemble the train as shown in Figure 13A-1 (Method 13A) with the filter between the third and fourth impingers. Alternatively, the filter may be placed between the probe the first impinger if a 20 mesh stainless steel screen is used for the filter support. 30 A filter heating system may be used to prevent moisture condensation, but the temperature around the filter holder shall not exceed 1200±14°C (248±25°F). [(Note: Whatman No. 1 filter decomposes at 150°C (300°F)).] Record filter location on the data sheet.

Place crushed ice around the impingers.

7.1.4 Leak check procedure—After the sampling train has been assembled, turn on and set (if applicable) the probe and filter heating system(s) to reach a temperature sufficient to avoid condensation in the probe. Allow time for the temperature to stabilize. Leak check the train at the sampling site by plugging the nozzle and pulling a 380 mm Hg (15 in. Hg) vacuum. A leakage rate in excess of 4% of the average sampling rate of 0.0057 m³/min. (0.02 cfm), whichever is less, is unacceptable.

The following leak check instruction for the sampling train described in APTD-0576 and APTD-0581 may be helpful. Start the pump with by-pass valve fully open and coarse adjust valve completely closed. Partially open the coarse adjust valve and slowly close the by-pass valve until 380 mm Hg (15 in. Hg) vacuum is reached. *Do Not* reverse direction of by-pass valve. This will cause water to back up into the filter holder. If 380 mm Hg (15 in. Hg) is exceeded, either leak check at this higher vacuum or end the leak check as described below and start over.

When the leak check is completed, first slowly remove the plug from the inlet to the probe or filter holder and immediately turn off the vacuum pump. This prevents the water in the impingers from being forced backward into the filter holder (if placed before the impingers) and silica gel from being entrained backward into the third impinger.

Leak checks shall be conducted as described whenever the train is disengaged, e.g. for silica gel or filter changes during the test, prior to each test run, and at the completion of each test run. If leaks are found to be in excess of the acceptable rate, the test will be considered invalid. To reduce lost time due to leakage occurrences, it is recommended that leak checks be conducted between port changes.

7.1.5 Particulate train operation—During the sampling run, an isokinetic sampling rate within 10%, or as specified by the Administrator, of true isokinetic shall be maintained.

For each run, record the data required on the example data sheet shown in Figure 13A-3 (Method 13A). Be sure to record the initial dry gas meter reading. Record the dry gas meter readings at the beginning and end of each sampling time increment, when changes in flow rates are made, and when sampling is halted. Take other data point readings at least once at each sample point during each time increment and additional readings when significant changes (20% variation in velocity head readings) necessitate additional adjustments in flow rate. Be sure to level and zero the manometer.

Clean the portholes prior to the test run to minimize chance of sampling deposited material. To begin sampling, remove the nozzle cap, verify (if applicable) that the probe heater is working and filter heater is up to temperature, and that the pitot tube and probe are properly positioned. Position the nozzle at the first traverse point with the tip pointing directly into the gas stream. Immediately start the pump and adjust the flow to isokinetic conditions. Nomographs are available for sampling trains using type S pitot tubes with 0.85±0.02 (coefficients (C_p), and when sampling in air or a stack gas with equivalent density (molecular weight, M_d, equal to 29±4), which aid in the rapid adjustment of the isokinetic sampling rate without excessive computations. APTD-0576 details the procedure for using these nomographs. If C_p and M_d are outside the above stated ranges, do not use the nomograph unless appropriate steps are taken to compensate for the deviations.

When the stack is under significant negative pressure (height of impinger stem), take care to close the coarse adjust valve before inserting the probe into the stack to avoid water backing into the filter holder. If necessary, the pump may be turned on with the coarse adjust valve closed.

When the probe is in position, block off the openings around the probe and porthole to prevent unrepresentative dilution of the gas stream.

Traverse the stack cross section, as required by Method 1 or as specified by the Administrator, being careful not to bump the probe nozzle into the stack walls when sampling near the walls or when removing or inserting the probe through the portholes to minimize chance of extracting deposited material.

During the test run, make periodic adjustments to keep the probe and (if applicable) filter temperatures at their proper values. Add more ice and, if necessary, salt to the ice bath, to maintain a temperature of less than 20°C (68°F) at the impinger/silica gel outlet, to avoid excessive moisture losses. Also, periodically check the level and zero of the manometer.

If the pressure drop across the filter becomes high enough to make isokinetic sampling difficult to maintain, the filter may be replaced in the midst of a sample run. It is recommended that another complete filter assembly be used rather than attempting to change the filter itself. After the new filter or filter assembly is installed, conduct a leak check. The final emission results shall be based on the summation of all filter catches.

A single train shall be used for the entire sample run, except for filter and silica gel changes. However, if approved by the Administrator, two or more trains may be used for a single test run when there are two or more ducts or sampling ports. The final emission results shall be based on the total of all sampling train catches.

At the end of the sample run, turn off the pump, remove the probe and nozzle from the stack, and record the final dry gas meter reading. Perform a leak check.[1] Calculate percent isokinetic (see calculation section) to determine whether another test run should be made. If there is difficulty in maintaining isokinetic rates due to source conditions, consult with the Administrator for possible variance on the isokinetic rates.

7.2 Sample recovery. Proper cleanup procedure begins as soon as the probe is removed from the stack at the end of the sampling period.

When the probe can be safely handled, wipe off all external particulate matter near the tip of the probe nozzle and place a cap over it to keep from losing part of the sample. Do not cap off the probe tip tightly while the sampling train is cooling down, as this would create a vacuum in the filter holder, thus drawing water from the impingers into the filter.

Before moving the sample train to the cleanup site, remove the probe from the sample train, wipe off the silicone grease, and cap the open outlet of the probe. Be careful not to lose any condensate, if present. Wipe off the silicone grease from the filter inlet where the probe was fastened and cap it. Remove the umbilical cord from the last impinger and cap the impinger. After wiping off the silicone grease, cap off the filter holder outlet and impinger inlet. Ground glass stoppers, plastic caps, or serum caps may be used to close these openings.

Transfer the probe and filter-impinger assembly to the cleanup area. This area should be clean and protected from the wind so that the chances of contaminating or losing the sample will be minimized.

Inspect the train prior to and during disassembly and note any abnormal conditions. Using a graduated cylinder, measure and record the volume of the water in the first three impingers, to the nearest ml; any condensate in the probe should be included in this determination. Treat the samples as follows:

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7.2.1 Container No. 1. Transfer the impinger water from the graduated cylinder to this container. Add the filter to this container. Wash all sample exposed surfaces, including the probe tip, probe, first three impingers, impinger connectors, filter holder, and graduated cylinder thoroughly with distilled water. Wash each component three separate times with water and clean the probe and nozzle with brushes. A maximum wash of 500 ml is used, and the washings are added to the sample container which must be made of polyethylene.

7.2.2 Container No. 2. Transfer the silica gel from the fourth impinger to this container and seal.

7.3 Analysis. Treat the contents of each sample container as described below.

7.3.1 Container No. 1.

7.3.1.1 Filter this container's contents, including the Whatman No 1 filter, through Whatman No. 541 filter paper, or equivalent into a 1500 ml beaker. NOTE: If filtrate volume exceeds 900 ml make filtrate basic with NaOH to phenolphthalein and evaporate to less than 900 ml.

7.3.1.2 Place the Whatman No. 541 filter containing the insoluble matter (including the Whatman No. 1 filter) in a nickel crucible, add a few ml of water and macerate the filter with a glass rod.

Add 100 mg CaO to the crucible and mix the contents thoroughly to form a slurry. Add a couple of drops of phenolphthalein indicator. The indicator will turn red in a basic medium. The slurry should remain basic during the evaporation of the water or fluoride ion will be lost. If the indicator turns colorless during the evaporation, an acidic condition is indicated. If this happens add CaO until the color turns red again.

Place the crucible in a hood under infrared lamps or on a hot plate at low heat. Evaporate the water completely.

After evaporation of the water, place the crucible on a hot plate under a hood and slowly increase the temperature until the paper chars. It may take several hours for complete charring of the filter to occur.

Place the crucible in a cold muffle furnace and gradually (to prevent smoking) increase the temperature to 600°C, and maintain until the contents are reduced to an ash. Remove the crucible from the furnace and allow it to cool.

7.3.1.3 Add approximately 4 g of crushed NaOH to the crucible and mix. Return the crucible to the muffle furnace, and fuse the sample for 10 minutes at 600°C.

Remove the sample from the furnace and cool to ambient temperature. Using several rinsings of warm distilled water transfer the contents of the crucible to the beaker containing the filtrate from container No. 1 (7.3.1). To assure complete sample removal, rinse finally with two 20 ml portions of 25 percent (v/v) sulfuric acid and carefully add to the beaker. Mix well and transfer to a one-liter volumetric flask. Dilute to volume with distilled water and mix thoroughly. Allow any undissolved solids to settle.

7.3.2 Container No. 2. Weigh the spent silica gel and report to the nearest 0.5 g.

7.3.3 Adjustment of acid/water ratio in distillation flask—(Utilize a protective shield when carrying out this procedure). Place 400 ml of distilled water in the distilling flask and add 200 ml of concentrated H_2SO_4. Caution: Observe standard precautions when mixing the H_2SO_4 by slowly adding the acid to the flask with constant swirling. Add some soft glass beads and several small pieces of broken glass tubing and assemble the apparatus as shown in Figure 13A-2. Heat the flask until it reaches a temperature of 175°C to adjust the acid/water ratio for subsequent distillations. Discard the distillate.

7.3.4 Distillation—Cool the contents of the distillation flask to below 80°C. Pipette an aliquot of sample containing less than 0.6 mg F directly into the distilling flask and add distilled water to make a total volume of 220 ml added to the distilling flask. [For an estimate of what size aliquot does not exceed 0.6 mg F, select an aliquot of the solution and treat as described in Section 7.3.5. This will give an approximation of the fluoride content, but only an approximation since interfering ions have not been removed by the distillation step.] 50

Place a 250 ml volumetric flask at the condenser exist. Now begin distillation and gradually increase the heat and collect all the distillate up to 175°C. Caution: Heating the solution above 175°C will cause sulfuric acid to distill over.

The acid in the distilling flask can be used until there is carryover of interferences or poor fluoride recovery. An occasional check of fluoride recovery with standard solutions is advised. The acid should be changed whenever there is less than 90 percent recovery or blank values are higher than 0.1 ug/ml.

7.3.5 Determination of concentration—Bring the distillate in the 250 ml volumetric flask to the mark with distilled water and mix thoroughly. Pipette a 25 ml aliquot from the distillate. Add an equal volume of TISAB and mix. The sample should be at the same temperature as the calibration standards when measurements are made. If ambient lab temperature fluctuates more than ±2°C from the temperature at which the calibration standards were measured, condition samples and standards in a constant temperature bath measurement. Stir the sample with a magnetic stirrer during measurement to minimize electrode response time. If the stirrer generates enough heat to change solution temperature, place a piece of insulating material such as cork between the stirrer and the beaker. Dilute samples (below 10^{-4} M fluoride ion content) should be held in polyethylene or polypropylene beakers during measurement.

Insert the fluoride and reference electrodes into the solution. When a steady millivolt reading is obtained, record it. This may take several minutes. Determine concentration from the calibration curve. Between electrode measurements, soak the fluoride sensing electrode in distilled water for 30 seconds and then remove and blot dry.

8. *Calibration.*

Maintain a laboratory log of all calibrations.

8.1 Sampling Train.

8.1.1 Probe nozzle—Using a micrometer, measure the inside diameter of the nozzle to the nearest 0.025 mm (0.001 in.). Make 3 separate measurements using different diameters each time and obtain the average of the measurements. The difference between the high and low numbers shall not exceed 0.1 mm (0.004 in.).

When nozzles become nicked, dented, or corroded, they shall be reshaped, sharpened, and recalibrated before use.

Each nozzle shall be permanently and uniquely identified.

8.1.2 Pitot tube—The pitot tube shall be calibrated according to the procedure outlined in Method 2.

8.1.3 Dry gas meter and orifice meter. Both meters shall be calibrated according to the procedure outlined in APTD-0576. When diaphragm pumps with by-pass valves are used, check for proper metering system design by calibrating the dry gas meter at an additional flow rate of 0.0057 m^3/min. (0.2 cfm) with the by-pass valve fully opened and then with it fully closed. If there is more than ±2 percent difference in flow rates when compared to the fully closed position of the by-pass valve, the system is not designed properly and must be corrected.

8.1.4 Probe heater calibration—The probe heating system shall be calibrated according to the procedure contained in APTD-0576. Probes constructed according to APTD-0581 need not be calibrated if the calibration curves in APTD-0576 are used.

8.1.5 Temperature gauges—Calibrate dial and liquid filled bulb thermometers against mercury-in-glass thermometers. Thermocouples need not be calibrated. For other devices, check with the Administrator.

8.2 Analytical Apparatus.

8.2.1 Fluoride Electrode—Prepare fluoride standardizing solutions by serial dilution of the 0.1 M fluoride standard solution. Pipet 10 ml of 0.1 M NaF into a 100 ml volumetric flask and make up to the mark with distilled water for a 10^{-2} M standard solution. Use 10 ml of 10^{-2} M solution to make a 10^{-3} M solution in the same manner. Repeat 10^{-4} and 10^{-5} M solutions.

Pipet 50 ml of each standard into a separate beaker. Add 50 ml of TISAB to each beaker. Place the electrode in the most dilute standard solution. When a steady millivolt reading is obtained, plot the value on the linear axis of semi-log graph paper versus concentration on the log axis. Plot the nominal value for concentration of the standard on the log axis, e.g., when 50 ml of

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[1] With acceptability of the test run to be based on the same criterion as in 7.1.4.

10^{-3} M standard is diluted with 50 ml TISAB, the concentration is still designated "10^{-3} M".

Between measurements soak the fluoride sensing electrode in distilled water for 30 seconds, and then remove and blot dry. Analyze the standards going from dilute to concentrated standards. A straight-line calibration curve will be obtained, with nominal concentrations of 10^{-5}, 10^{-5}, 10^{-4}, 10^{-3}, 10^{-4} concentrations of 10^{-5}, 10^{-4}, 10^{-4}, 10^{-3}, 10^{-1} concentrations of 10^{-5}, 10^{-4}, 10^{-4}, 10^{-5}, 10^{-5} fluoride molarity on the log axis plotted versus electrode potential (in millivolts) on the linear scale.

Calibrate the fluoride electrode daily, and check it hourly. Prepare fresh fluoride standardizing solutions daily of 10^{-3} M or less. Store fluoride standardizing solutions in polyethylene or polypropylene containers. (Note: Certain specific ion meters have been designed specifically for fluoride electrode use and give a direct readout of fluoride ion concentration. These meters may be used in lieu of calibration curves for fluoride measurements over narrow concentration ranges. Calibrate the meter according to manufacturer's instructions.)

9. *Calculations.*

Carry out calculations, retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after final calculation.

9.1 Nomenclature.

A_n=Cross sectional area of nozzle, m^2 (ft^2).

A_t=Aliquot of total sample added to still, ml.

B_{ws}=Water vapor in the gas stream, proportion by volume.

C_s=Concentration of fluoride in stack gas, mg/m^3, corrected to standard conditions of 20° C, 760 mm Hg (68° F, 29.92 in. Hg) on dry basis.

F_t=Total weight of fluoride in sample, mg.

I=Percent of isokinetic sampling.

M=Concentration of fluoride from calibration curve, molarity.

m_n=Total amount of particulate matter collected, mg.

M_w=Molecular weight of water, 18 g/g-mole (18 lb/lb-mole).

m_a=Mass of residue of acetone after evaporation, mg.

P_{bar}=Barometric pressure at the sampling site, mm Hg (in. Hg).

P_s=Absolute stack gas pressure, mm Hg (in. Hg).

P_{std}=Standard absolute pressure, 760 mm Hg (29.92 in. Hg).

R=Ideal gas constant, 0.06236 mm Hg-m^3/°K-g-mole (21.83 in. Hg-ft^3/°R-lb-mole).

T_m=Absolute average dry gas meter temperature (see fig. 13A–3), °K (°R).

T_s=Absolute average stack gas temperature (see fig. 13A–3), °K (°R).

T_{std}=Standard absolute temperature, 293° K (528° R).

V_a=Volume of acetone blank, ml.

V_{aw}=Volume of acetone used in wash, ml.

V_d=Volume of distillate collected, ml.

V_{lc}=Total volume of liquid collected in impingers and silica gel, ml. Volume of water in silica gel equals silica gel weight increase in grams times 1 ml/gram. Volume of liquid collected in impinger equals final volume minus initial volume.

V_m=Volume of gas sample as measured by dry gas meter, dcm (dcf).

$V_{m(std)}$=Volume of gas sample measured by the dry gas meter corrected to standard conditions, dscm (dscf).

$V_{w(std)}$=Volume of water vapor in the gas sample corrected to standard conditions, scm (scf).

V_t=Total volume of sample, ml.

v_s=Stack gas velocity, calculated by Method 2, Equation 2–7 using data obtained from Method 5, m/sec (ft/sec).

W_a=Weight of residue in acetone wash, mg.

ΔH=Average pressure differential across the orifice (see fig. 13A–3), meter, mm H_2O (in. H_2O).

ρ_a=Density of acetone, mg/ml (see label on bottle).

ρ_w=Density of water, 1 g/ml (0.00220 lb/ml).

Θ=Total sampling time, min.

13.6=Specific gravity of mercury.

60=Sec/min.

100=Conversion to percent.

9.2 Average dry gas meter temperature and average orifice pressure drop. See data sheet (Figure 13A–3 of Method 13A).

9.3 Dry gas volume. Use Section 9.3 of Method 13A.

9.4 Volume of Water Vapor. Use Section 9.4 of Method 13A.

9.5 Moisture Content. Use Section 9.5 of Method 13A.

9.6 Concentration

9.6.1 Calculate the amount of fluoride in the sample according to equation 13B–1.

$$F_t = K \frac{V_t}{A_t} (V_d)\ (M)$$

where:

K=19 mg/ml.

9.6.2 Concentration of fluoride in stack gas. Use Section 9.6.2 of Method 13A.

9.7 Isokinetic variation. Use Section 9.7 of Method 13A.

9.8 Acceptable results. Use Section 9.8 of Method 13A.

10. *References.*

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Standard Methods for the Examination of Water and Waste Water, published jointly by American Public Health Association, American Water Works Association and Water Pollution Control Federation, 13th Edition (1971).

(Sections 111 and 114 of the Clean Air Act, as amended by section 4(a) of Pub. L. 91–604, 84 Stat. 1678 (42 U.S.C. 1857 c–6, c–9))

[FR Doc.75–20478 Filed 8–5–75;8:45 am]

METHOD 14—DETERMINATION OF FLUORIDE EMISSIONS FROM POTROOM ROOF MONITORS OF PRIMARY ALUMINUM PLANTS 27

1. *Principle and applicability.*

1.1 *Principle.* Gaseous and particulate fluoride roof monitor emissions are drawn into a permanent sampling manifold through several large nozzles. The sample is transported from the sampling manifold to ground level through a duct. The gas in the duct is sampled using Method 13A or 13B—DETERMINATION OF TOTAL FLUORIDE EMISSIONS FROM STATIONARY SOURCES. Effluent velocity and volumetric flow rate are determined with anemometers permanently located in the roof monitor.

1.2 *Applicability.* This method is applicable for the determination of fluoride emissions from stationary sources only when specified by the test procedures for determining compliance with new source performance standards.

2. *Apparatus.*

2.1.1 *Anemometers.* Vane or propeller anemometers with a velocity measuring threshold as low as 15 meters/minute and a range up to at least 600 meters/minute. Each anemometer shall generate an electrical signal which can be calibrated to the velocity measured by the anemometer. Anemometers shall be able to withstand dusty and corrosive atmospheres.

One anemometer shall be installed for every 85 meters of roof monitor length. If the roof monitor length divided by 85 meters is not a whole number, round the fraction to the nearest whole number to determine the number of anemometers needed. Use one anemometer for any roof monitor less than 85 meters long. Permanently mount the anemometers at the center of each equal length along the roof monitor. One anemometer shall be installed in the same section of the roof monitor that contains the sampling manifold (see section 2.2.1). Make a velocity traverse of the width of the roof monitor where an anemometer is to be placed. This traverse may be made with any suitable low velocity measuring device, and shall be made during normal process operating conditions. Install the anemometer at a point of average velocity along this traverse.

2.1.2 *Recorders.* Recorders equipped with signal transducers for converting the electrical signal from each anemometer to a continuous recording of air flow velocity, or to an integrated measure of volumetric flow. For the purpose of recording velocity, "continuous" shall mean one readout per 15-minute or shorter time interval. A constant amount of time shall elapse between readings. Volumetric flow rate may be determined by an electrical count of anemometer revolutions. The recorders or counters shall permit identification of the velocities or flow rate measured by each individual anemometer.

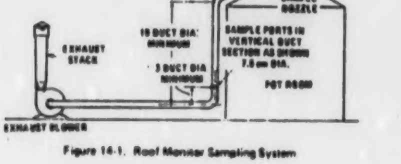

Figure 14-1. Roof Monitor Sampling System

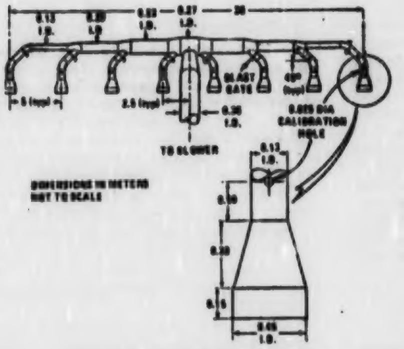

Figure 14-2. Sampling Manifold and Nozzles.

2.2 Roof monitor air sampling system.

2.2.1 *Sampling ductwork.* The manifold system and connecting duct shall be permanently installed to draw an air sample from the roof monitor to ground level. A typical installation of duct for drawing a sample from a roof monitor to ground level is shown in Figure 14-1. A plan of a manifold system that is located in a roof monitor is shown in Figure 14-2. These drawings represent a typical installation for a generalized roof monitor. The dimensions on these figures may be altered slightly to make the manifold system fit into a particular roof monitor, but the general configuration shall be followed. There shall be eight nozzles, each having a diameter of 0.40 to 0.50 meters. The length of the manifold system from the first nozzle to the eighth shall be 35 meters or eight percent of the length of the roof monitor, whichever is greater. The duct leading from the roof monitor manifold shall be round with a diameter of 0.30 to 0.40 meters. As shown in Figure 14-2, each of the sample legs of the manifold shall have a device, such as a blast gate or valve, to enable adjustment of flow into each sample nozzle.

Locate the manifold along the length of the roof monitor so that it lies near the midsection of the roof monitor. If the design of a particular roof monitor makes this impossible, the manifold may be located elsewhere along the roof monitor, but avoid locating the manifold near the ends of the roof monitor or in a section where the aluminum reduction pot arrangement is not typical of the rest of the potroom. Center the sample nozzles in the throat of the roof monitor. (See Figure 14-1.) Construct all sample-exposed surfaces within the nozzles, manifold and sample duct of 316 stainless steel. Aluminum may be used if a new ductwork system is conditioned with fluoride-laden roof monitor air for a period of six weeks prior to initial testing. Other materials of construction may be used if it is demonstrated through comparative testing that there is no loss of fluorides in the system. All connections in the ductwork shall be leak free.

Locate two sample ports in a vertical section of the duct between the roof monitor and exhaust fan. The sample ports shall be at least 10 duct diameters downstream and two diameters upstream from any flow disturbance such as a bend or contraction. The two sample ports shall be situated 90° apart. One of the sample ports shall be situated so that the duct can be traversed in the plane of the nearest upstream duct bend.

2.2.2 *Exhaust fan.* An industrial fan or blower to be attached to the sample duct at ground level. (See Figure 14-1.) This exhaust fan shall have a maximum capacity such that a large enough volume of air can be pulled through the ductwork to maintain an isokinetic sampling rate in all the sample nozzles for all flow rates normally encountered in the roof monitor.

The exhaust fan volumetric flow rate shall be adjustable so that the roof monitor air can be drawn isokinetically into the sample nozzles. This control of flow may be achieved by a damper on the inlet to the exhauster or by any other workable method.

2.3 Temperature measurement apparatus.

2.3.1 *Thermocouple.* Installed in the roof monitor near the sample duct.

2.3.2 *Signal transducer.* Transducer to change the thermocouple voltage output to a temperature readout.

2.3.3 *Thermocouple wire.* To reach from roof monitor to signal transducer and recorder.

2.3.4 *Sampling train.* Use the train described in Methods 13A and 13B—Determination of total fluoride emissions from stationary sources.

3. Reagents.

3.1 *Sampling and analysis.* Use reagents described in Method 13A or 13B—Determination of total fluoride emissions from stationary sources.

4. Calibration.

4.1 *Propeller anemometer.* Calibrate the anemometers so that their electrical signal output corresponds to the velocity or volumetric flow they are measuring. Calibrate according to manufacturer's instructions.

4.2 *Manifold intake nozzles.* Adjust the exhaust fan to draw a volumetric flow rate (refer to Equation 14-1) such that the entrance velocity into each manifold nozzle approximates the average effluent velocity in the roof monitor. Measure the velocity of the air entering each nozzle by inserting an S type pitot tube into a 2.5 cm or less diameter hole (see Figure 14-2) located in the manifold between each blast gate (or valve) and nozzle. The pitot tube tip shall be extended into the center of the manifold. Take care to insure that there is no leakage around the pitot probe which could affect the indicated velocity in the manifold leg. If the velocity of air being drawn into each nozzle is not the same, open or close each blast gate (or valve) until the velocity in each nozzle is the same. Fasten each blast gate (or valve) so that it will remain in this position and close the pitot port holes. This calibration shall be performed when the manifold system is installed. (Note: It is recommended that this calibration be repeated at least once a year.)

5. Procedure.

5.1 *Roof monitor velocity determination.*

5.1.1 *Velocity value for setting isokinetic flow.* During the 24 hours preceding a test run, determine the velocity indicated by the propeller anemometer in the section of roof monitor containing the sampling manifold. Velocity readings shall be taken every 15 minutes or at shorter equal time intervals. Calculate the average velocity for the 24-hour period.

5.1.2 *Velocity determination during a test run.* During the actual test run, record the velocity or volume readings of each propeller anemometer in the roof monitor. Velocity readings shall be taken for each anemometer every 15 minutes or at shorter equal time intervals (or continuously).

5.2 *Temperature recording.* Record the temperature of the roof monitor every two hours during the test run.

5.3 *Sampling.*

5.3.1 *Preliminary air flow in duct.* During the 24 hours preceding the test, turn on the exhaust fan and draw roof monitor air through the manifold duct to condition the ductwork. Adjust the fan to draw a volumetric flow through the duct such that the velocity of gas entering the manifold nozzles approximates the average velocity of the air leaving the roof monitor.

5.3.2 *Isokinetic sample rate adjustment.* Adjust the fan so that the volumetric flow rate in the duct is such that air enters into the manifold sample nozzles at a velocity equal to the 24-hour average velocity determined under 5.1.1. Equation 14-1 gives the correct stream velocity which is needed in the duct at the sample ports in order for sample gas to be drawn isokinetically into the manifold nozzles. Perform a pitot traverse of the duct at the sample ports to determine if the correct average velocity in the duct has been achieved. Perform the pitot determination according to Method 2. Make this determination before the start of a test run. The fan setting need not be changed during the run.

$$V_d = \frac{8\,(D_n)^2}{(D_d)^2}\,(V_m)\,\frac{1\ \text{minute}}{60\ \text{sec}}$$

where:

V_d=desired velocity in duct at sample ports, meter/sec.

D_n=diameter of a roof monitor manifold nozzle, meters.

D_d=diameter of duct at sample port, meters.

V_m=average velocity of the air stream in the roof monitor, meters/minute, as determined under section 5.1.1.

5.3.3 *Sample train operation.* Sample the duct using the standard fluoride train and methods described in Methods 13A and 13B—Determination of total fluoride emissions from stationary sources. Select sample traverse points according to Method 1. If a selected sampling point is less than one inch from the stack wall, adjust the location of that point to one inch away from the wall.

5.3.4 *Each test run shall last eight hours or more.* If a question exists concerning the representativeness of an eight-hour test, a longer test period up to 24 hours may be selected. Conduct each run during a period when all normal operations are performed underneath the sampling manifold, i.e. tapping, anode changes, maintenance, and other normal duties. All pots in the potroom shall be operated in a normal manner during the test period.

5.3.5 *Sample recovery.* Same as Method 13A or 13B—Determination of total fluoride emissions from stationary sources.

5.4 *Analysis.* Same as Method 13A or 13B—Determination of total fluoride emissions from stationary sources.

6. Calculations.

6.1 *Isokinetic sampling test.* Calculate the mean velocity measured during each sampling run by the anemometer in the section of the roof monitor containing the sampling manifold. If the mean velocity recorded during a particular test run does not fall within ±20 percent of the mean velocity established according to 5.3.2, repeat the run.

6.2 *Average velocity of roof monitor gases.* Calculate the average roof monitor velocity using all the velocity or volumetric flow readings from section 5.1.2.

6.3 *Roof monitor temperature.* Calculate the mean value of the temperatures recorded in section 5.2.

6.4 *Concentration of fluorides in roof monitor air in mg F/m³.* This is given by Equation 13A-5 in Method 13A—Determination of total fluoride emissions from stationary sources.

6.5 Average volumetric flow from roof is given by Equation 14-2.

$$Q_m = \frac{V_{mt}\,(A)\,(M_d)\,P_m\,(294°\text{K})}{(T_m + 273°)\,(760\ \text{mm Hg})}$$

where:

Q_m=average volumetric flow from roof monitor at standard conditions on a dry basis, m³/min.

A=roof monitor open area, m².

V_{mt}=average velocity of air in the roof monitor, meters/minute, from section 6.2.

P_m=atmospheric pressure, mm Hg.

T_m=roof monitor temperature, °C, from section 6.3.

M_d=mole fraction of dry gas, which is given by $M_d = \frac{100 - 100\,(B_{ws})}{100}$

B_{ws}=is the proportion by volume of water vapor in the gas stream, from Equation 13A-3, Method 13A—Determination of total fluoride emissions from stationary sources.

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).). 66

APPENDIX B—PERFORMANCE SPECIFICATIONS[18]

Performance Specification 1—Performance specifications and specification test procedures for transmissometer systems for continuous measurement of the opacity of stack emissions.[23]

1. Principle and Applicability.

1.1 Principle. The opacity of particulate matter in stack emissions is measured by a continuously operating emission measurement system. These systems are based upon the principle of transmissometry which is a direct measurement of the attenuation of visible radiation (opacity) by particulate matter in a stack effluent. Light having specific spectral characteristics is projected from a lamp across the stack of a pollutant source to a light sensor. The light is attenuated due to absorption and scatter by the particulate matter in the effluent. The percentage of visible light attenuated is defined as the opacity of the emission. Transparent stack emissions that do not attenuate light will have a transmittance of 100 or an opacity of 0. Opaque stack emissions that attenuate all of the visible light will have a transmittance of 0 or an opacity of 100 percent. The transmissometer is evaluated by use of neutral density filters to determine the precision of the continuous monitoring system. Tests of the system are performed to determine zero drift, calibration drift, and response time characteristics of the system.

1.2 Applicability. This performance specification is applicable to the continuous monitoring systems specified in the subparts for measuring opacity of emissions. Specifications for continuous measurement of visible emissions are given in terms of design, performance, and installation parameters. These specifications contain test procedures, installation requirements, and data computation procedures for evaluating the acceptability of the continuous monitoring systems subject to approval by the Administrator.

2. Apparatus.

2.1 Calibrated Filters. Optical filters with neutral spectral characteristics and known optical densities to visible light or screens known to produce specified optical densities. Calibrated filters with accuracies certified by the manufacturer to within ±3 percent opacity shall be used. Filters required are low, mid, and high-range filters with nominal optical densities as follows when the transmissometer is spanned at opacity levels specified by applicable subparts:

Span value (percent opacity)	Calibrated filter optical densities with equivalent opacity in parenthesis		
	Low-range	Mid-range	High-range
50	0.1 (20)	0.2 (37)	0.3 (50)
60	.1 (20)	.2 (37)	.3 (50)
70	.1 (20)	.3 (50)	.4 (60)
80	.1 (20)	.3 (50)	.6 (75)
90	.1 (20)	.4 (60)	.7 (80)
100	.1 (20)	.4 (60)	.9 (87½)

It is recommended that filter calibrations be checked with a well-collimated photopic transmissometer of known linearity prior to use. The filters shall be of sufficient size to attenuate the entire light beam of the transmissometer.

2.2 Data Recorder. Analog chart recorder or other suitable device with input voltage range compatible with the analyzer system output. The resolution of the recorder's data output shall be sufficient to allow completion of the test procedures within this specification.[23]

2.3 Opacity measurement System. An in-stack transmissometer (folded or single path) with the optical design specifications designated below, associated control units and apparatus to keep optical surfaces clean.

3. Definitions.

3.1 Continuous Monitoring System. The total equipment required for the determination of pollutant opacity in a source effluent. Continuous monitoring systems consist of major subsystems as follows:

3.1.1 Sampling Interface. The portion of a continuous monitoring system for opacity that protects the analyzer from the effluent.

3.1.2 Analyzer. That portion of the continuous monitoring system which senses the pollutant and generates a signal output that is a function of the pollutant opacity.

3.1.3 Data Recorder. That portion of the continuous monitoring system that processes the analyzer output and provides a permanent record of the output signal in terms of pollutant opacity.

3.2 Transmissometer. The portions of a continuous monitoring system for opacity that include the sampling interface and the analyzer.

3.3 Span. The value of opacity at which the continuous monitoring system is set to produce the maximum data display output. The span shall be set at an opacity specified in each applicable subpart.

3.4 Calibration Error. The difference between the opacity reading indicated by the continuous monitoring system and the known values of a series of test standards. For this method the test standards are a series of calibrated optical filters or screens.

3.5 Zero Drift. The change in continuous monitoring system output over a stated period of time of normal continuous operation when the pollutant concentration at the time of the measurements is zero.

3.6 Calibration Drift. The change in the continuous monitoring system output over a stated period of time of normal continuous operation when the pollutant concentration at the time of the measurements is the same known upscale value.

3.7 System Response. The time interval from a step change in opacity in the stack at the input to the continuous monitoring system to the time at which 95 percent of the corresponding final value is reached as displayed on the continuous monitoring system data recorder.

3.8 Operational Test Period. A minimum period of time over which a continuous monitoring system is expected to operate within certain performance specifications without unscheduled maintenance, repair, or adjustment.

3.9 Transmittance. The fraction of incident light that is transmitted through an optical medium of interest.

3.10 Opacity. The fraction of incident light that is attenuated by an optical medium of interest. Opacity (O) and transmittance (T) are related as follows:

$$O=1-T$$

3.11 Optical Density. A logarithmic measure of the amount of light that it attenuated by an optical medium of interest. Optical density (D) is related to the transmittance and opacity as follows:

$$D=-\log_{10}T$$

$$D=-\log_{10}(1-O)$$

3.12 Peak Optical Response. The wavelength of maximum sensitivity of the instrument.

3.13 Mean Spectral Response. The wavelength which bisects the total area under the curve obtained pursuant to paragraph 9.2.1.

3.14 Angle of View. The maximum (total) angle of radiation detection by the photodetector assembly of the analyzer.

3.15 Angle of Projection. The maximum (total) angle that contains 95 percent of the radiation projected from the lamp assembly of the analyzer.

3.16 Pathlength. The depth of effluent in the light beam between the receiver and the transmitter of the single-pass transmissometer, or the depth of effluent between the transceiver and reflector of a double-pass transmissometer. Two pathlengths are referenced by this specification:

3.16.1 Monitor Pathlength. The depth of effluent at the installed location of the continuous monitoring system.

3.16.2 Emission Outlet Pathlength. The depth of effluent at the location emissions are released to the atmosphere.

4. Installation Specification.

4.1 Location. The transmissometer must be located across a section of duct or stack that will provide a particulate matter flow through the optical volume of the transmissometer that is representative of the particulate matter flow through the duct or stack. It is recommended that the monitor pathlength or depth of effluent for the transmissometer include the entire diameter of the duct or stack. In installations using a shorter pathlength, extra caution must be used in determining the measurement location representative of the particulate matter flow through the duct or stack.

4.1.1 The transmissometer location shall be downstream from all particulate control equipment.

4.1.2 The transmissometer shall be located as far from bends and obstructions as practical.

4.1.3 A transmissometer that is located in the duct or stack following a bend shall be installed in the plane defined by the bend where possible.

4.1.4 The transmissometer should be installed in an accessible location.

4.1.5 When required by the Administrator, the owner or operator of a source must demonstrate that the transmissometer is located in a section of duct or stack where a representative particulate matter distribution exists. The determination shall be accomplished by examining the opacity profile of the effluent at a series of positions across the duct or stack while the plant is in operation at maximum or reduced operating rates or by other tests acceptable to the Administrator.

4.2 Slotted Tube. Installations that require the use of a slotted tube shall use a slotted tube of sufficient size and blackness so as not to interfere with the free flow of effluent through the entire optical volume of the transmissometer or reflect light into the transmissometer photodetector. Light reflections may be prevented by using blackened baffles within the slotted tube to prevent the lamp radiation from impinging upon the tube walls, by restricting the angle of projection of the light and the angle of view of the photodetector assembly to less than the cross-sectional area of the slotted tube, or by other methods. The owner or operator must show that the manufacturer of the monitoring system has used appropriate methods to minimize light reflections for systems using slotted tubes.

4.3 Data Recorder Output. The continuous monitoring system output shall permit expanded display of the span opacity on a standard 0 to 100 percent scale. Since all opacity standards are based on the opacity of the effluent exhausted to the atmosphere, the system output shall be based upon the emission outlet pathlength and permanently recorded. For affected facilities whose monitor pathlength is different from the facility's emission outlet pathlength, a graph shall be provided with the installation to show the relationships between the continuous monitoring system recorded opacity based upon the emission outlet pathlength and the opacity of the effluent at the analyzer location (monitor pathlength). Tests for measurement of opacity that are required by this performance specification are based upon the monitor pathlength. The graph necessary to convert the data recorder output to the monitor pathlength basis shall be established as follows: 23

$$\log(1-O_1)=(l_1/l_2)\log(1-O_2)$$

where:

O_1 = the opacity of the effluent based upon l_1.
O_2 = the opacity of the effluent based upon l_2.
l_1 = the emission outlet pathlength.
l_2 = the monitor pathlength.

5. Optical Design Specifications.

The optical design specifications set forth in Section 6.1 shall be met in order for a measurement system to comply with the requirements of this method.

6. Determination of Conformance with Design Specifications.

6.1 The continuous monitoring system for measurement of opacity shall be demonstrated to conform to the design specifications set forth as follows:

6.1.1 Peak Spectral Response. The peak spectral response of the continuous monitoring systems shall occur between 500 nm and 600 nm. Response at any wavelength below 400 nm or above 700 nm shall be less than 10 percent of the peak response of the continuous monitoring system.

6.1.2 Mean Spectral Response. The mean spectral response of the continuous monitoring system shall occur between 500 nm and 600 nm.

6.1.3 Angle of View. The total angle of view shall be no greater than 5 degrees.

6.1.4 Angle of Projection. The total angle of projection shall be no greater than 5 degrees.

6.2 Conformance with the requirements of section 6.1 may be demonstrated by the owner or operator of the affected facility by testing each analyser or by obtaining a certificate of conformance from the instrument manufacturer. The certificate must certify that at least one analyser from each month's production was tested and satisfactorily met all applicable requirements. The certificate must state that the first analyser randomly sampled met all requirements of paragraph 6 of this specification. If any of the requirements were not met, the certificate must show that the entire month's analyser production was resampled according to the military standard 105D sampling procedure (MIL-STD-105D) inspection level II; was retested for each of the applicable requirements under paragraph 6 of this specification; and was determined to be acceptable under MIL-STD-105D procedures. The certificate of conformance must show the results of each test performed for the analysers sampled during the month the analyser being installed was produced. 37

6.3 The general test procedures to be followed to demonstrate conformance with Section 6 requirements are given as follows: (These procedures will not be applicable to all designs and will require modification in some cases. Where analyser and optical design is certified by the manufacturer to conform with the angle of view or angle of projection specifications, the respective procedures may be omitted.)

6.3.1 Spectral Response. Obtain spectral data for detector, lamp, and filter components used in the measurement system from their respective manufacturers.

6.3.2 Angle of View. Set the received up as specified by the manufacturer. Draw an arc with radius of 3 meters. Measure the receiver response to a small (less than 3 centimeters) non-directional light source at 5-centimeter intervals on the arc for 26 centimeters on either side of the detector centerline. Repeat the test in the vertical direction.

6.3.3 Angle of Projection. Set the projector up as specified by the manufacturer. Draw an arc with radius of 3 meters. Using a small photoelectric light detector (less than 3 centimeters), measure the light intensity at 5-centimeter intervals on the arc for 26 centimeters on either side of the light source centerline of projection. Repeat the test in the vertical direction.

7. Continuous Monitoring System Performance Specifications.

The continuous monitoring system shall meet the performance specifications in Table 1-1 to be considered acceptable under this method.

TABLE 1-1.—*Performance specifications*

Parameter	*Specifications*
a. Calibration error	≤3 pct opacity.[1]
b Zero drift (24 h)	≤2 pct opacity.[1]
c. Calibration drift (24 h)	≤2 pct opacity.[1]
d. Response time	10 s (maximum).
e. Operational test period	168 h.

[1] Expressed as sum of absolute mean value and the 95 pct confidence interval of a series of tests.

8. Performance Specification Test Procedures. The following test procedures shall be used to determine conformance with the requirements of paragraph 7:

8.1 Calibration Error and Response Time Test. These tests are to be performed prior to installation of the system on the stack and may be performed at the affected facility or at other locations provided that proper notification is given. Set up and calibrate the measurement system as specified by the manufacturer's written instructions for the monitor pathlength to be used in the installation. Span the analyser as specified in applicable subparts.

8.1.1 Calibration Error Test. Insert a series of calibration filters in the transmissometer path at the midpoint. A minimum of three calibration filters (low, mid, and high-range) selected in accordance with the table under paragraph 2.1 and calibrated within 3 percent must be used. Make a total of five nonconsecutive readings for each filter. Record the measurement system output readings in percent opacity. (See Figure 1–1.)

8.1.2 System Response Test. Insert the high-range filter in the transmissometer path five times and record the time required for the system to respond to 95 percent of final zero and high-range filter values. (See Figure 1–2.)

8.2 Field Test for Zero Drift and Calibration Drift. Install the continuous monitoring system on the affected facility and perform the following alignments:

8.2.1 Preliminary Alignments. As soon as possible after installation and once a year thereafter when the facility is not in operation, perform the following optical and zero alignments:

8.2.1.1 Optical Alignment. Align the light beam from the transmissometer upon the optical surfaces located across the effluent (i.e., the retroflector or photodetector as applicable) in accordance with the manufacturer's instructions.

8.2.1.2 Zero Alignment. After the transmissometer has been optically aligned and the transmissometer mounting is mechanically stable (i.e., no movement of the mounting due to thermal contraction of the stack, duct, etc.) and a clean stack condition has been determined by a steady zero opacity condition, perform the zero alignment. This alignment is performed by balancing the continuous monitor system response so that any simulated zero check coincides with an actual zero check performed across the monitor pathlength of the clean stack.

8.2.1.3 Span. Span the continuous monitoring system at the opacity specified in subparts and offset the zero setting at least 10 percent of span so that negative drift can be quantified.

8.2.2. Final Alignments. After the preliminary alignments have been completed and the affected facility has been started up and reaches normal operating temperature, recheck the optical alignment in accordance with 8.2.1.1 of this specification. If the alignment has shifted, realign the optics, record any detectable shift in the opacity measured by the system that can be attributed to the optical realignment, and notify the Administrator. This condition may not be objectionable if the affected facility operates within a fairly constant and adequately narrow range of operating temperatures that does not produce significant shifts in optical alignment during normal operation of the facility. Under circumstances where the facility operations produce fluctuations in the effluent gas temperature that result in significant misalignments, the Administrator may require improved mounting structures or another location for installation of the transmissometer.

8.2.3 Conditioning Period. After completing the post-startup alignments, operate the system for an initial 168-hour conditioning period in a normal operational manner.

8.2.4 Operational Test Period. After completing the conditioning period, operate the system for an additional 168-hour period retaining the zero offset. The system shall monitor the source effluent at all times except when being zeroed or calibrated. At 24-hour intervals the zero and span shall be checked according to the manufacturer's instructions. Minimum procedures used shall provide a system check of the analyser internal mirrors and all electronic circuitry including the lamp and photodetector assembly and shall include a procedure for producing a simulated zero opacity condition and a simulated upscale (span) opacity condition as viewed by the receiver. The manufacturer's written instructions may be used providing that they equal or exceed these minimum procedures. Zero and span the transmissometer, clean all optical surfaces exposed to the effluent, realign optics, and make any necessary adjustments to the calibration of the system daily. These zero and calibration adjustments and optical realignments are allowed only at 24-hour intervals or at such shorter intervals as the manufacturer's written instructions specify. Automatic corrections made by the measurement system without operator intervention are allowable at any time. The magnitude of any zero or span drift adjustments shall be recorded. During this 168-hour operational test period, record the following at 24-hour intervals: (a) the zero reading and span readings after the system is calibrated (these readings should be set at the same value at the beginning of each 24-hour period);. (b) the zero reading after each 24 hours of operation, but before cleaning and adjustment; and (c) the span reading after cleaning and zero adjustment, but before span adjustment. (See Figure 1–3.)

9. Calculation, Data Analysis, and Reporting.

9.1 Procedure for Determination of Mean Values and Confidence Intervals.

9.1.1 The mean value of the data set is calculated according to equation 1-1.

$$\bar{x}=\frac{1}{n}\sum_{i=1}^{n}x_i \qquad \text{Equation 1-1}$$

where x_i = absolute value of the individual measurements,

Σ = sum of the individual values.
$\bar{x}$ = mean value, and
n = number of data points. 23

9.1.2 The 95 percent confidence interval (two-sided) is calculated according to equation 1-2:

$$C.I._{95}=\frac{t_{.975}}{n\sqrt{n-1}}\sqrt{n(\sum x_i^2)-(\sum x_i)^2} \qquad \text{Equation 1-2}$$

where

$\sum x_i$ = sum of all data points,
$t_{.975}=t_1-\alpha/2$, and
$C.I._{95}$ = 95 percent confidence interval estimate of the average mean value.

The values in this table are already corrected for n-1 degrees of freedom. Use n equal to the number of samples as data points.

Values for $t_{.975}$

n	$t_{.975}$	n	$t_{.975}$
2	12.706	10	2.262
3	4.303	11	2.228
4	3.182	12	2.201
5	2.776	13	2.179
6	2.571	14	2.160
7	2.447	15	2.145
8	2.365	16	2.131
9	2.306		

9.2 Data Analysis and Reporting.

9.2.1 Spectral Response. Combine the spectral data obtained in accordance with paragraph 6.3.1 to develop the effective spectral response curve of the transmissometer. Report the wavelength at which the peak response occurs, the wavelength at which the mean response occurs, and the maximum response at any wavelength below 400 nm and above 700 nm expressed as a percentage of the peak response as required under paragraph 6.2.

9.2.2 Angle of View. Using the data obtained in accordance with paragraph 6.3.2, calculate the response of the receiver as a function of viewing angle in the horizontal and vertical directions (26 centimeters of arc with a radius of 3 meters equal 5 degrees). Report relative angle of view curves as required under paragraph 6.2.

9.2.3 Angle of Projection. Using the data obtained in accordance with paragraph 6.3.3, calculate the response of the photoelectric detector as a function of projection angle in the horizontal and vertical directions. Report relative angle of projection curves as required under paragraph 6.2.

9.2.4 Calibration Error. Using the data from paragraph 8.1 (Figure 1-1), subtract the known filter opacity value from the value shown by the measurement system for each of the 15 readings. Calculate the mean and 95 percent confidence interval of the five different values at each test filter value according to equations 1-1 and 1-2. Report the sum of the absolute mean difference and the 95 percent confidence interval for each of the three test filters.

Low Range ____% opacity Span Value _____% opacity	Mid Range ___% opacity	High Range ___% opacity
Date of Test ______________	Location of Test ______________	

	Calibrated Filter[1]	Analyzer Reading % Opacity	Differences[2] % Opacity
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			

	Low	Mid	High
Mean difference	___	___	___
Confidence interval	___	___	___
Calibration error = Mean Difference[3] + C.I.	___	___	___

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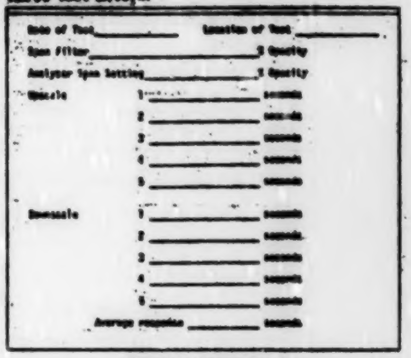
[1] Low, mid or high range

[2] Calibration filter opacity - analyzer reading

[3] Absolute value

Figure 1-1. Calibration Error Test



Date of Test ______________ Location of Test ______________

Span Filter ______________ % Opacity

Analyzer Span Setting ______________ % Opacity

Upscale 1 ______________ seconds

2 ______________ seconds

3 ______________ seconds

4 ______________ seconds

5 ______________ seconds

Downscale 1 ______________ seconds

2 ______________ seconds

3 ______________ seconds

4 ______________ seconds

5 ______________ seconds

Average response ______________ seconds

Figure 1-2. Response Time Test

9.2.5 Zero Drift. Using the zero opacity values measured every 24 hours during the field test (paragraph 8.2), calculate the differences between the zero point after cleaning, aligning, and adjustment, and the zero value 24 hours later just prior to cleaning, aligning, and adjustment. Calculate the mean value of these points and the confidence interval using equations 1-1 and 1-2. Report the sum of the absolute mean value and the 95 percent confidence interval.

9.2.6 Calibration Drift. Using the span value measured every 24 hours during the field test, calculate the differences between the span value after cleaning, aligning, and adjustment of zero and span, and the span value 24 hours later just after cleaning, aligning, and adjustment of zero and before adjustment of span. Calculate the mean value of these points and the confidence interval using equations 1-1 and 1-2. Report the sum of the absolute mean value and the confidence interval.

9.2.7 Response Time. Using the data from paragraph 8.1, calculate the time interval from filter insertion to 95 percent of the final stable value for all upscale and downscale traverses. Report the mean of the 10 upscale and downscale test times.

9.2.8 Operational Test Period. During the 168-hour operational test period, the continuous monitoring system shall not require any corrective maintenance, repair, replacement, or adjustment other than that clearly specified as required in the manufacturer's operation and maintenance manuals as routine and expected during a one-week period. If the continuous monitoring system is operated within the specified performance parameters and does not require corrective maintenance, repair, replacement, or adjustment other than as specified above during the 168-hour test period, the operational test period shall have been successfully concluded. Failure of the continuous monitoring system to meet these requirements shall call for a repetition of the 168-hour test period. Portions of the tests which were satisfactorily completed need not be repeated. Failure to meet any performance specification(s) shall call for a repetition of the one-week operational test period and that specific portion of the tests required by paragraph 8 related to demonstrating compliance with the failed specification. All maintenance and adjustments required shall be recorded. Output readings shall be recorded before and after all adjustments.

10. References.

10.1 "Experimental Statistics," Department of Commerce, National Bureau of Standards Handbook 91, 1963, pp. 3-31, paragraphs 3-3.1.4.

10.2 "Performance Specifications for Stationary-Source Monitoring Systems for Gases and Visible Emissions," Environmental Protection Agency, Research Triangle Park, N.C., EPA-650/2-74-013, January 1974.

Zero Setting ____________ (See paragraph 8.2.1) Date of Test ________________

Span Setting ____________

Date and Time	Zero Reading (Before cleaning and adjustment)	Zero Drift (ΔZero)	Span Reading (After cleaning and zero adjustment but before span adjustment)	Calibration Drift (ΔSpan)

Zero Drift = Mean Zero Drift* ____________ + CI (Zero) ____________ = ____________.

Calibration Drift = Mean Span Drift* ____________ + CI (Span) ____ ____ = ____________.

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* Absolute value

PERFORMANCE SPECIFICATION 2—PERFORMANCE SPECIFICATIONS AND SPECIFICATION TEST PROCEDURES FOR MONITORS OF SO_2 AND NO_x FROM STATIONARY SOURCES

1. Principle and Applicability.

1.1 Principle. The concentration of sulfur dioxide or oxides of nitrogen pollutants in stack emissions is measured by a continuously operating emission measurement system. Concurrent with operation of the continuous monitoring system, the pollutant concentrations are also measured with reference methods (Appendix A). An average of the continuous monitoring system data is computed for each reference method testing period and compared to determine the relative accuracy of the continuous monitoring system. Other tests of the continuous monitoring system are also performed to determine calibration error, drift, and response characteristics of the system.

1.2 Applicability. This performance specification is applicable to evaluation of continuous monitoring systems for measurement of nitrogen oxides or sulfur dioxide pollutants. These specifications contain test procedures, installation requirements, and data computation procedures for evaluating the acceptability of the continuous monitoring systems.

2. Apparatus.

2.1 Calibration Gas Mixtures. Mixtures of known concentrations of pollutant gas in a diluent gas shall be prepared. The pollutant gas shall be sulfur dioxide or the appropriate oxide(s) of nitrogen specified by paragraph 6 and within subparts. For sulfur dioxide gas mixtures, the diluent gas may be air or nitrogen. For nitric oxide (NO) gas mixtures, the diluent gas shall be oxygen-free (<10 ppm) nitrogen, and for nitrogen dioxide (NO_2) gas mixtures the diluent gas shall be air. Concentrations of approximately 50 percent and 90 percent of span are required. The 90 percent gas mixture is used to set and to check the span and is referred to as the span gas.

2.2 Zero Gas. A gas certified by the manufacturer to contain less than 1 ppm of the pollutant gas or ambient air may be used.

2.3 Equipment for measurement of the pollutant gas concentration using the reference method specified in the applicable standard.

2.4 Data Recorder. Analog chart recorder or other suitable device with input voltage range compatible with analyzer system output. The resolution of the recorder's data output shall be sufficient to allow completion of the test procedures within this specification.

2.5 Continuous monitoring system for SO_2 or NO_x pollutants as applicable.

3. Definitions.

3.1 Continuous Monitoring System. The total equipment required for the determination of a pollutant gas concentration in a source effluent. Continuous monitoring systems consist of major subsystems as follows:

3.1.1 Sampling Interface—That portion of an extractive continuous monitoring system that performs one or more of the following operations: acquisition, transportation, and conditioning of a sample of the source effluent or that portion of an in-situ continuous monitoring system that protects the analyzer from the effluent.

3.1.2 Analyzer—That portion of the continuous monitoring system which senses the pollutant gas and generates a signal output that is a function of the pollutant concentration.

3.1.3 Data Recorder—That portion of the continuous monitoring system that provides a permanent record of the output signal in terms of concentration units.

3.2 Span. The value of pollutant concentration at which the continuous monitoring system is set to produce the maximum data display output. The span shall be set at the concentration specified in each applicable subpart.

3.3 Accuracy (Relative). The degree of correctness with which the continuous monitoring system yields the value of gas concentration of a sample relative to the value given by a defined reference method. This accuracy is expressed in terms of error, which is the difference between the paired concentration measurements expressed as a percentage of the mean reference value.

3.4 Calibration Error. The difference between the pollutant concentration indicated by the continuous monitoring system and the known concentration of the test gas mixture.

3.5 Zero Drift. The change in the continuous monitoring system output over a stated period of time of normal continuous operation when the pollutant concentration at the time for the measurements is zero.

3.6 Calibration Drift. The change in the continuous monitoring system output over a stated time period of normal continuous operations when the pollutant concentration at the time of the measurements is the same known upscale value.

3.7 Response Time. The time interval from a step change in pollutant concentration at the input to the continuous monitoring system to the time at which 95 percent of the corresponding final value is reached as displayed on the continuous monitoring system data recorder.

3.8 Operational Period. A minimum period of time over which a measurement system is expected to operate within certain performance specifications without unscheduled maintenance, repair, or adjustment.

3.9 Stratification. A condition identified by a difference in excess of 10 percent between the average concentration in the duct or stack and the condentration at any point more than 1.0 meter from the duct or stack wall.

4. Installation Specifications. Pollutant continuous monitoring systems (SO_2 and NO_x) shall be installed at a sampling location where measurements can be made which are directly representative (4.1), or which can be corrected so as to be representative (4.2) of the total emissions from the affected facility. Conformance with this requirement shall be accomplished as follows:

4.1 Effluent gases may be assumed to be nonstratified if a sampling location eight or more stack diameters (equivalent diameters) downstream of any air in-leakage is selected. This assumption and data correction procedures under paragraph 4.2.1 may not be applied to sampling locations upstream of an air preheater in a steam generating facility under Subpart D of this part. For sampling locations where effluent gases are either demonstrated (4.3) or may be assumed to be nonstratified (eight diameters), a point (extractive systems) or path (in-situ systems) of average concentration may be monitored. 23

4.2 For sampling locations where effluent gases cannot be assumed to be nonstratified (less than eight diameters) or have been shown under paragraph 4.3 to be stratified, results obtained must be consistently representative (e.g. a point of average concentration may shift with load changes) or the data generated by sampling at a point (extractive systems) or across a path (in-situ systems) must be corrected (4.2.1 and 4.2.2) so as to be representative of the total emissions from the affected facility. Conformance with this requirement may be accomplished in either of the following ways:

4.2.1 Installation of a diluent continuous monitoring system (O_2 or CO_2 as applicable) in accordance with the procedures under paragraph 4.2 of Performance Specification 3 of this appendix. If the pollutant and diluent monitoring systems are not of the same type (both extractive or both in-situ), the extractive system must use a multipoint probe.

4.2.2 Installation of extractive pollutant monitoring systems using multipoint sampling probes or in-situ pollutant monitoring systems that sample or view emissions which are consistently representative of the total emissions for the entire cross section. The Administrator may require data to be submitted to demonstrate that the emissions sampled or viewed are consistently representative for several typical facility process operating conditions.

4.3 The owner or operator may perform a traverse to characterize any stratification of effluent gases that might exist in a stack or duct. If no stratification is present, sampling procedures under paragraph 4.1 may be applied even though the eight diameter criteria is not met.

4.4 When single point sampling probes for extractive systems are installed within the stack or duct under paragraphs 4.1 and 4.2.1, the sample may not be extracted at any point less than 1.0 meter from the stack or duct wall. Multipoint sampling probes installed under paragraph 4.2.2 may be located at any points necessary to obtain consistently representative samples.

5. Continuous Monitoring System Performance Specifications.

The continuous monitoring system shall meet the performance specifications in Table 2-1 to be considered acceptable under this method.

TABLE 2-1.—*Performance specifications*

Parameter	*Specification*
1. Accuracy [1]	≤20 pct of the mean value of the reference method test data.
2. Calibration error [1]	≤5 pct of each (50 pct, 90 pct) calibration gas mixture value.
3. Zero drift (2 h) [1]	2 pct of span
4. Zero drift (24 h) [1]	Do.
5. Calibration drift (2 h) [1]	Do.
6. Calibration drift (24 h) [1]	2.5 pct. of span
7. Response time	15 min maximum.
8. Operational period	168 h minimum.

[1] Expressed as sum of absolute mean value plus 95 pct confidence interval of a series of tests.

6. Performance Specification Test Procedures. The following test procedures shall be used to determine conformance with the requirements of paragraph 5. For NO_x an- requirements of paragraph 5. For NO_x analyzers that oxidize nitric oxide (NO) to nitrogen dioxide (NO_2), the response time test under paragraph 6.3 of this method shall be performed using nitric oxide (NO) span gas. Other tests for NO_x continuous monitoring systems under paragraphs 6.1 and 6.2 and all tests for sulfur dioxide systems shall be performed using the pollutant span gas specified by each subpart.

6.1 Calibration Error Test Procedure. Set up and calibrate the complete continuous monitoring system according to the manufacturer's writen instructions. This may be accomplished either in the laboratory or in the field.

6.1.1 Calibration Gas Analyses. Triplicate analyses of the gas mixtures shall be performed within two weeks prior to use using Reference Methods 6 for SO_2 and 7 for NO_x. Analyze each calibration gas mixture (50%, 90%) and record the results on the example sheet shown in Figure 2-1. Each sample test result must be within 20 percent of the averaged result or the tests shall be repeated. This step may be omitted for non-extractive monitors where dynamic calibration gas mixtures are not used (6.1.2).

6.1.2 Calibration Error Test Procedure. Make a total of 15 nonconsecutive measurements by alternately using zero gas and each calibration gas mixture concentration (e.g., 0%, 50%, 0%, 90%, 50%, 90%, 50%, 0%, etc.). For nonextractive continuous monitoring systems, this test procedure may be performed by using two or more calibration gas cells whose concentrations are certified by the manufacturer to be functionally equivalent to these gas concentrations. Convert the continuous monitoring system output readings to ppm and record the results on the example sheet shown in Figure 2-2.

6.2 Field Test for Accuracy (Relative), Zero Drift, and Calibration Drift. Install and operate the continuous monitoring system in accordance with the manufacturer's written instructions and drawings as follows:

6.2.1 Conditioning Period. Offset the zero setting at least 10 percent of the span so that negative zero drift can be quantified. Operate the system for an initial 168-hour conditioning period in normal operating manner.

6.2.2 Operational Test Period. Operate the continuous monitoring system for an additional 168-hour period retaining the zero offset. The system shall monitor the source effluent at all times except when being zeroed, calibrated, or backpurged.

6.2.2.1 Field Test for Accuracy (Relative). For continuous monitoring systems employing extractive sampling, the probe tip for the continuous monitoring system and the probe tip for the Reference Method sampling train should be placed at adjacent locations in the duct. For NO_x continuous monitoring systems, make 27 NO_x concentration measurements, divided into nine sets, using the applicable reference method. No more than one set of tests, consisting of three individual measurements, shall be performed in any one hour. All individual measurements of each set shall be performed concurrently, or within a three-minute interval and the results averaged. For SO_2 continuous monitoring systems, make nine SO_2 concentration measurements using the applicable reference method. No more than one measurement shall be performed in any one hour. Record the reference method test data and the continuous monitoring system concentrations on the example data sheet shown in Figure 2-3.

6.2.2.2 Field Test for Zero Drift and Calibration Drift. For extractive systems, determine the values given by zero and span gas pollutant concentrations at two-hour intervals until 15 sets of data are obtained. For nonextractive measurement systems, the zero value may be determined by mechanically producing a zero condition that provides a system check of the analyzer internal mirrors and all electronic circuitry including the radiation source and detector assembly or by inserting three or more calibration gas cells and computing the zero point from the upscale measurements. If this latter technique is used, a graph(s) must be retained by the owner or operator for each measurement system that shows the relationship between the upscale measurements and the zero point. The span of the system shall be checked by using a calibration gas cell certified by the manufacturer to be functionally equivalent to 50 percent of span concentration. Record the zero and span measurements (or the computed zero drift) on the example data sheet shown in Figure 2-4. The two-hour periods over which measurements are conducted need not be consecutive but may not overlap. All measurements required under this paragraph may be conducted concurrent with tests under paragraph 6.2.2.1.

6.2.2.3 Adjustments. Zero and calibration corrections and adjustments are allowed only at 24-hour intervals or at such shorter intervals as the manufacturer's written instructions specify. Automatic corrections made by the measurement system without operator intervention or initiation are allowable at any time. During the entire 168-hour operational test period, record on the example sheet shown in Figure 2-5 the values given by zero and span gas pollutant concentrations before and after adjustment at 24-hour intervals.

6.3 Field Test for Response Time.

6.3.1 Scope of Test. Use the entire continuous monitoring system as installed, including sample transport lines if used. Flow rates, line diameters, pumping rates, pressures (do not allow the pressurized calibration gas to change the normal operating pressure in the sample line), etc., shall be at the nominal values for normal operation as specified in the manufacturer's written instructions. If the analyzer is used to sample more than one pollutant source (stack), repeat this test for each sampling point.

6.3.2 Response Time Test Procedure. Introduce zero gas into the continuous monitoring system sampling interface or as close to the sampling interface as possible. When the system output reading has stabilized, switch quickly to a known concentration of pollutant gas. Record the time from concentration switching to 95 percent of final stable response. For non-extractive monitors, the highest available calibration gas concentration shall be switched into and out of the sample path and response times recorded. Perform this test sequence three (3) times. Record the results of each test on the example sheet shown in Figure 2-6.

7. Calculations, Data Analysis and Reporting.

7.1 Procedure for determination of mean values and confidence intervals.

7.1.1 The mean value of a data set is calculated according to equation 2-1.

$$\bar{x}=\frac{1}{n}\sum_{i=1}^{n} x_i \qquad \text{Equation 2-1}$$

where:

x_i=absolute value of the measurements,
Σ=sum of the individual values,
$\bar{x}$=mean value, and
n=number of data points. 23

7.1.2 The 95 percent confidence interval (two-sided) is calculated according to equation 2-2:

$$C.I._{95}=\frac{t_{.975}}{n\sqrt{n-1}}\sqrt{n(\sum x_i^2)-(\sum x_i)^2} \qquad \text{Equation 2-2}$$

where:

$\sum x_i$=sum of all data points,
$t_{.975}=t_1-\alpha/2$, and
$C.I._{95}$=95 percent confidence interval estimate of the average mean value.

23

Values for $t_{.975}$

n	$t_{.975}$
2	12.706
3	4.303
4	3.182
5	2.776
6	2.571
7	2.447
8	2.365
9	2.306
10	2.262
11	2.228
12	2.201
13	2.179
14	2.160
15	2.145
16	2.131

The values in this table are already corrected for n-1 degrees of freedom. Use n equal to the number of samples as data points.

7.2 Data Analysis and Reporting.

7.2.1 Accuracy (Relative). For each of the nine reference method test points, determine the average pollutant concentration reported by the continuous monitoring system. These average concentrations shall be determined from the continuous monitoring system data recorded under 7.2.2 by integrating or averaging the pollutant concentrations over each of the time intervals concurrent with each reference method testing period. Before proceeding to the next step, determine the basis (wet or dry) of the continuous monitoring system data and reference method test data concentrations. If the bases are not consistent, apply a moisture correction to either reference method concentrations or the continuous monitoring system concentrations as appropriate. Determine the correction factor by moisture tests concurrent with the reference method testing periods. Report the moisture test method and the correction procedure employed. For each of the nine test runs determine the difference for each test run by subtracting the respective reference method test concentrations (use average of each set of three measurements for NO_x) from the continuous monitoring system integrated or averaged concentrations. Using these data, compute the mean difference and the 95 percent confidence interval of the differences (equations 2-1 and 2-2). Accuracy is reported as the sum of the absolute value of the mean difference and the 95 percent confidence interval of the differences expressed as a percentage of the mean reference method value. Use the example sheet shown in Figure 2-3.

7.2.2 Calibration Error. Using the data from paragraph 6.1, subtract the measured pollutant concentration determined under paragraph 6.1.1 (Figure 2-1) from the value shown by the continuous monitoring system for each of the five readings at each concentration measured under 6.1.2 (Figure 2-2). Calculate the mean of these difference values and the 95 percent confidence intervals according to equations 2-1 and 2-2. Report the calibration error (the sum of the absolute value of the mean difference and the 95 percent confidence interval) as a percentage of each respective calibration gas concentration. Use example sheet shown in Figure 2-2.

7.2.3 Zero Drift (2-hour). Using the zero concentration values measured each two hours during the field test, calculate the differences between consecutive two-hour readings expressed in ppm. Calculate the mean difference and the confidence interval using equations 2-1 and 2-2. Report the zero drift as the sum of the absolute mean value and the confidence interval as a percentage of span. Use example sheet shown in Figure 2-4.

7.2.4 Zero Drift (24-hour). Using the zero concentration values measured every 24 hours during the field test, calculate the differences between the zero point after zero adjustment and the zero value 24 hours later just prior to zero adjustment. Calculate the mean value of these points and the confidence interval using equations 2-1 and 2-2. Report the zero drift (the sum of the absolute mean and confidence interval) as a percentage of span. Use example sheet shown in Figure 2-5.

7.2.5 Calibration Drift (2-hour). Using the calibration values obtained at two-hour intervals during the field test, calculate the differences between consecutive two-hour readings expressed as ppm. These values should be corrected for the corresponding zero drift during that two-hour period. Calculate the mean and confidence interval of these corrected difference values using equations 2-1 and 2-2. Do not use the differences between non-consecutive readings. Report the calibration drift as the sum of the absolute mean and confidence interval as a percentage of span. Use the example sheet shown in Figure 2-4.

7.2.6 Calibration Drift (24-hour). Using the calibration values measured every 24 hours during the field test, calculate the differences between the calibration concentration reading after zero and calibration adjustment, and the calibration concentration reading 24 hours later after zero adjustment but before calibration adjustment. Calculate the mean value of these differences and the confidence interval using equations 2-1 and 2-2. Report the calibration drift (the sum of the absolute mean and confidence interval) as a percentage of span. Use the example sheet shown in Figure 2-5.

7.2.7 Response Time. Using the charts from paragraph 6.3, calculate the time interval from concentration switching to 95 percent to the final stable value for all upscale and downscale tests. Report the mean of the three upscale test times and the mean of the three downscale test times. The two average times should not differ by more than 15 percent of the slower time. Report the slower time as the system response time. Use the example sheet shown in Figure 2-6.

7.2.8 Operational Test Period. During the 168-hour performance and operational test period, the continuous monitoring system shall not require any corrective maintenance, repair, replacement, or adjustment other than that clearly specified as required in the operation and maintenance manuals as routine and expected during a one-week period. If the continuous monitoring system operates within the specified performance parameters and does not require corrective maintenance, repair, replacement or adjustment other than as specified above during the 168-hour test period, the operational period will be successfully concluded. Failure of the continuous monitoring system to meet this requirement shall call for a repetition of the 168-hour test period. Portions of the test which were satisfactorily completed need not be repeated. Failure to meet any performance specifications shall call for a repetition of the one-week performance test period and that portion of the testing which is related to the failed specification. All maintenance and adjustments required shall be recorded. Output readings shall be recorded before and after all adjustments.

8. References.

8.1 "Monitoring Instrumentation for the Measurement of Sulfur Dioxide in Stationary Source Emissions," Environmental Protection Agency, Research Triangle Park, N.C., February 1973.

8.2 "Instrumentation for the Determination of Nitrogen Oxides Content of Stationary Source Emissions," Environmental Protection Agency, Research Triangle Park, N.C., Volume 1, APTD-0847, October 1971; Volume 2, APTD-0942, January 1972.

3.3 "Experimental Statistics," Department of Commerce, Handbook 91, 1963, pp. 3-31, paragraphs 3-3.1.4.

8.4 "Performance Specifications for Stationary-Source Monitoring Systems for Gases and Visible Emissions," Environmental Protection Agency, Research Triangle Park, N.C., EPA-650/2-74-013, January 1974.

Date ______ Reference Method Used ______

Mid-Range Calibration Gas Mixture

Sample 1 ______ ppm

Sample 2 ______ ppm

Sample 3 ______ ppm

Average ______ ppm

High-Range (span) Calibration Gas Mixture

Sample 1 ______ ppm

Sample 2 ______ ppm

Sample 3 ______ ppm

Average ______ ppm

Figure 2-1. Analysis of Calibration Gas Mixtures

Calibration Gas Mixture Data (From Figure 2-1)

Mid (50%) _____ppm   High (90%) _____ppm

Run #	Calibration Gas Concentration, ppm	Measurement System Reading, ppm	Differences,[1] ppm
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			

	Mid	High
Mean difference	_____	_____
Confidence interval	± _____	± _____
Calibration error = $\frac{\text{Mean Difference}^2 + \text{C.I.}}{\text{Average Calibration Gas Concentration}} \times 100$	_____ %	_____ %

---

[1] Calibration gas concentration - measurement system reading

[2] Absolute value

Figure 2-2. Calibration Error Determination

Test No.	Date and Time	Reference Method Samples					Analyzer 1-Hour Average (ppm)*		Difference (ppm)	
		SO_2 Sample 1 (ppm)	NO_x Sample 1 (ppm)	NO_x Sample 2 (ppm)	NO_x Sample 3 (ppm)	NO_x Sample Average (ppm)	SO_2	NO_x	SO_2	NO_x
1										
2										
3										
4										
5										
6										
7										
8										
9										

Mean reference method test value (SO_2) _____

Mean reference method test value (NO_x) _____

Mean of the differences _____

95% Confidence intervals = ± _____ ppm (SO_2) = ± _____ ppm (NO_x)

Accuracies = $\frac{\text{Mean of the differences} + \text{95\% confidence interval}}{\text{Mean reference method value}} \times 100$ = _____% (SO_2) = _____% (NO_x)

* Explain and report method used to determine integrated averages

Figure 2-3. Accuracy Determination (SO_2 and NO_x) 57

Data Set No.	Time		Date	Zero Reading	Zero Drift (ΔZero)	Span Reading	Span Drift (ΔSpan)	Calibration Drift (Span- Zero)
	Begin	End						
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								

Zero Drift = [Mean Zero Drift* ________ + CI (Zero) ________] ÷ [Span] x 100 = ________.
Calibration Drift = [Mean Span Drift* ________ + CI (Span) ________] ÷ [Span] x 100 = ________.
*Absolute Value.

Figure 2-4. Zero and Calibration Drift (2 Hour)

Date and Time	Zero Reading	Zero Drift (ΔZero)	Span Reading (After zero adjustment)	Calibration Drift (ΔSpan)

Zero Drift = [Mean Zero Drift* ________ + C.I. (Zero) ________]
÷ [Instrument Span] x 100 = ________.
Calibration Drift = [Mean Span Drift* ________ + C.I. (Span) ________]
÷ [Instrument Span] x 100 = ________.
* Absolute value

Figure 2-5. Zero and Calibration Drift (24-hour)

Date of Test ____________

Span Gas Concentration ________ppm

Analyzer Span Setting ________ppm

Upscale
1 ________seconds
2 ________seconds
3 ________seconds
Average upscale response ________seconds

Downscale
1 ________seconds
2 ________seconds
3 ________seconds
Average downscale response ________seconds

System average response time (slower time) = ________seconds.

%deviation from slower system average response $= \left[\frac{\text{average upscale minus average downscale}}{\text{slower time}}\right] \times 100\% =$ ____.

Figure 2-6. Response Time

Performance Specification 3—Performance specifications and specification test procedures for monitors of CO_2 and O_2 from stationary sources.

1. Principle and Applicability.

1.1 Principle. Effluent gases are continuously sampled and are analyzed for carbon dioxide or oxygen by a continuous monitoring system. Tests of the system are performed during a minimum operating period to determine zero drift, calibration drift, and response time characteristics.

1.2 Applicability. This performance specification is applicable to evaluation of continuous monitoring systems for measurement of carbon dioxide or oxygen. These specifications contain test procedures, installation requirements, and data computation procedures for evaluating the acceptability of the continuous monitoring systems subject to approval by the Administrator. Sampling may include either extractive or non-extractive (in-situ) procedures.

2. Apparatus.

2.1 Continuous Monitoring System for Carbon Dioxide or Oxygen.

2.2 Calibration Gas Mixtures. Mixture of known concentrations of carbon dioxide or oxygen in nitrogen or air. Midrange and 90 percent of span carbon dioxide or oxygen concentrations are required. The 90 percent of span gas mixture is to be used to set and check the analyzer span and is referred to as span gas. For oxygen analyzers, if the span is higher than 21 percent O_2, ambient air may be used in place of the 90 percent of span calibration gas mixture. Triplicate analyses of the gas mixture (except ambient air) shall be performed within two weeks prior to use using Reference Method 3 of this part.

2.3 Zero Gas. A gas containing less than 100 ppm of carbon dioxide or oxygen.

2.4 Data Recorder. Analog chart recorder or other suitable device with input voltage range compatible with analyzer system output. The resolution of the recorder's data output shall be sufficient to allow completion of the test procedures within this specification.

3. Definitions.

3.1 Continuous Monitoring System. The total equipment required for the determination of carbon dioxide or oxygen in a given source effluent. The system consists of three major subsystems:

3.1.1 Sampling Interface. That portion of the continuous monitoring system that performs one or more of the following operations: delineation, acquisition, transportation, and conditioning of a sample of the source effluent or protection of the analyzer from the hostile aspects of the sample or source environment.

3.1.2 Analyzer. That portion of the continuous monitoring system which senses the pollutant gas and generates a signal output that is a function of the pollutant concentration.

3.1.3 Data Recorder. That portion of the continuous monitoring system that provides a permanent record of the output signal in terms of concentration units.

3.2 Span. The value of oxygen or carbon dioxide concentration at which the continuous monitoring system is set that produces the maximum data display output. For the purposes of this method, the span shall be set no less than 1.5 to 2.5 times the normal carbon dioxide or normal oxygen concentration in the stack gas of the affected facility.

3.3 Midrange. The value of oxygen or carbon dioxide concentration that is representative of the normal conditions in the stack gas of, the affected facility at typical operating rates.

3.4 Zero Drift. The change in the continuous monitoring system output over a stated period of time of normal continuous operation when the carbon dioxide or oxygen concentration at the time for the measurements is zero.

3.5 Calibration Drift. The change in the continuous monitoring system output over a stated time period of normal continuous operation when the carbon dioxide or oxygen continuous monitoring system is measuring the concentration of span gas.

3.6 Operational Test Period. A minimum period of time over which the continuous monitoring system is expected to operate within certain performance specifications without unscheduled maintenance, repair, or adjustment.

3.7 Response time. The time interval from a step change in concentration at the input to the continuous monitoring system to the time at which 95 percent of the corresponding final value is displayed on the continuous monitoring system data recorder.

4. Installation Specification.

Oxygen or carbon dioxide continuous monitoring systems shall be installed at a location where measurements are directly representative of the total effluent from the affected facility or representative of the same effluent sampled by a SO_2 or NO_x continuous monitoring system. This requirement shall be complied with by use of applicable requirements in Performance Specification 2 of this appendix as follows:

4.1 Installation of Oxygen or Carbon Dioxide Continuous Monitoring Systems Not Used to Convert Pollutant Data. A sampling location shall be selected in accordance with the procedures under paragraphs 4.2.1 or 4.2.2, or Performance Specification 2 of this appendix.

4.2 Installation of Oxygen or Carbon Dioxide Continuous Monitoring Systems Used to Convert Pollutant Continuous Monitoring System Data to Units of Applicable Standards. The diluent continuous monitoring system (oxygen or carbon dioxide) shall be installed at a sampling location where measurements that can be made are representative of the effluent gases sampled by the pollutant continuous monitoring system(s). Conformance with this requirement may be accomplished in any of the following ways:

4.2.1 The sampling location for the diluent system shall be near the sampling location for the pollutant continuous monitoring system such that the same approximate point(s) (extractive systems) or path (in-situ systems) in the cross section is sampled or viewed.

4.2.2 The diluent and pollutant continuous monitoring systems may be installed at different locations if the effluent gases at both sampling locations are nonstratified as determined under paragraphs 4.1 or 4.3, Performance Specification 2 of this appendix and there is no in-leakage occurring between the two sampling locations. If the effluent gases are stratified at either location, the procedures under paragraph 4.2.2, Performance Specification 2 of this appendix shall be used for installing continuous monitoring systems at that location.

5. Continuous Monitoring System Performance Specifications.

The continuous monitoring system shall meet the performance specifications in Table 3-1 to be considered acceptable under this method.

6. Performance Specification Test Procedures.

The following test procedures shall be used to determine conformance with the requirements of paragraph 4. Due to the wide variation existing in analyser designs and principles of operation, these procedures are not applicable to all analysers. Where this occurs, alternative procedures, subject to the approval of the Administrator, may be employed. Any such alternative procedures must fulfill the same purposes (verify response, drift, and accuracy) as the following procedures, and must clearly demonstrate conformance with specifications in Table 3-1.

6.1 Calibration Check. Establish a calibration curve for the continuous monitoring system using zero, midrange, and span concentration gas mixtures. Verify that the resultant curve of analyzer reading compared with the calibration gas value is consistent with the expected response curve as described by the analyzer manufacturer. If the expected response curve is not produced, additional calibration gas measurements shall be made, or additional steps undertaken to verify the accuracy of the response curve of the analyzer.

6.2 Field Test for Zero Drift and Calibration Drift. Install and operate the continuous monitoring system in accordance with the manufacturer's written instructions and drawings as follows:

TABLE 3-1.—*Performance specifications*

Parameter	*Specification*
1. Zero drift (2 h) [1]	$\leqq$0.4 pct O_2 or CO_2.
2. Zero drift (24 h) [1]	$\leqq$0.5 pct O_2 or CO_2.
3. Calibration drift (2 h) [1]	$\leqq$0.4 pct O_2 or CO_2.
4. Calibration drift (24 h) [1]	$\leqq$0.5 pct O_2 or CO_2.
5. Operational period	168 h minimum.
6. Response time	10 min.

[1] Expressed as sum of absolute mean value plus 95 pct confidence interval of a series of tests.

6.2.1 Conditioning Period. Offset the zero setting at least 10 percent of span so that negative zero drift may be quantified. Operate the continuous monitoring system for an initial 168-hour conditioning period in a normal operational manner.

6.2.2. Operational Test Period. Operate the continuous monitoring system for an additional 168-hour period maintaining the zero offset. The system shall monitor the source effluent at all times except when being zeroed, calibrated, or backpurged.

6.2.3 Field Test for Zero Drift and Calibration Drift. Determine the values given by zero and midrange gas concentrations at two-hour intervals until 15 sets of data are obtained. For non-extractive continuous monitoring systems, determine the zero value given by a mechanically produced zero condition or by computing the zero value from upscale measurements using calibrated gas cells certified by the manufacturer. The midrange checks shall be performed by using certified calibration gas cells functionally equivalent to less than 50 percent of span. Record these readings on the example sheet shown in Figure 3-1. These two-hour periods need not be consecutive but may not overlap. In-situ CO_2 or O_2 analyzers which cannot be fitted with a calibration gas cell may be calibrated by alternative procedures acceptable to the Administrator. Zero and calibration corrections and adjustments are allowed only at 24-hour intervals or at such shorter intervals as the manufacturer's written instructions specify. Automatic corrections made by the continuous monitoring system without operator intervention or initiation are allowable at any time. During the entire 168-hour test period, record the values given by zero and span gas concentrations before and after adjustment at 24-hour intervals in the example sheet shown in Figure 3-2.

6.3 Field Test for Response Time.

6.3.1 Scope of Test.

This test shall be accomplished using the continuous monitoring system as installed, including sample transport lines if used. Flow rates, line diameters, pumping rates, pressures (do not allow the pressurized calibration gas to change the normal operating pressure in the sample line), etc., shall be at the nominal values for normal operation as specified in the manufacturer's written instructions. If the analyzer is used to sample more than one source (stack), this test shall be repeated for each sampling point.

6.3.2 Response Time Test Procedure.

Introduce zero gas into the continuous monitoring system sampling interface or as close to the sampling interface as possible. When the system output reading has stabilized, switch quickly to a known concentration of gas at 90 percent of span. Record the time from concentration switching to 95 percent of final stable response. After the system response has stabilized at the upper level, switch quickly to a zero gas. Record the time from concentration switching to 95 percent of final stable response. Alternatively, for nonextractive continuous monitoring systems, the highest available calibration gas concentration shall be switched into and out of the sample path and response times recorded. Perform this test sequence three (3) times. For each test, record the results on the data sheet shown in Figure 3-3.

7. Calculations, Data Analysis, and Reporting.

7.1 Procedure for determination of mean values and confidence intervals.

7.1.1 The mean value of a data set is calculated according to equation 3-1.

$$\bar{x} = \frac{1}{n} \sum_{i=1}^{n} x_i \qquad \text{Equation 3-1}$$

where:

x_i = absolute value of the measurements,
Σ = sum of the individual values,
$\bar{x}$ = mean value, and
n = number of data points.

7.2.1 The 95 percent confidence interval (two-sided) is calculated according to equation 3-2:

$$C.I._{95} = \frac{t_{.975}}{n\sqrt{n-1}} \sqrt{n(\sum x_i^2) - (\sum x_i)^2} \qquad \text{Equation 3-2}$$

where:

ΣX = sum of all data points,
$t_{.975} = t_{1-\alpha/2}$, and 23
$C.I._{95}$ = 95 percent confidence interval estimates of the average mean value

Values for $t_{.975}$

n	$t_{.975}$
2	12.706
3	4.303
4	3.182
5	2.776
6	2.571
7	2.447
8	2.365
9	2.306
10	2.262
11	2.223
12	2.201
13	2.179
14	2.160
15	2.145
16	2.131

The values in this table are already corrected for n-1 degrees of freedom. Use n equal to the number of samples as data points.

7.2 Data Analysis and Reporting.

7.2.1 Zero Drift (2-hour). Using the zero concentration values measured each two hours during the field test, calculate the differences between the consecutive two-hour readings expressed in ppm. Calculate the mean difference and the confidence interval using equations 3-1 and 3-2. Record the sum of the absolute mean value and the confidence interval on the data sheet shown in Figure 3-1.

7.2.2 Zero Drift (24-hour). Using the zero concentration values measured every 24 hours during the field test, calculate the differences between the zero point after zero adjustment and the zero value 24 hours later just prior to zero adjustment. Calculate the mean value of these points and the confidence interval using equations 3-1 and 3-2. Record the zero drift (the sum of the absolute mean and confidence interval) on the data sheet shown in Figure 3-2.

7.2.3 Calibration Drift (2-hour). Using the calibration values obtained at two-hour intervals during the field test, calculate the differences between consecutive two-hour readings expressed as ppm. These values should be corrected for the corresponding zero drift during that two-hour period. Calculate the mean and confidence interval of these corrected difference values using equations 3-1 and 3-2. Do not use the differences between non-consecutive readings. Record the sum of the absolute mean and confidence interval upon the data sheet shown in Figure 3-1.

7.2.4 Calibration Drift (24-hour). Using the calibration values measured every 24 hours during the field test, calculate the differences between the calibration concentration reading after zero and calibration adjustment and the calibration concentration reading 24 hours later after zero adjustment but before calibration adjustment. Calculate the mean value of these differences and the confidence interval using equations 3-1 and 3-2. Record the sum of the absolute mean and confidence interval on the data sheet shown in Figure 3-2.

7.2.5 Operational Test Period. During the 168-hour performance and operational test period, the continuous monitoring system shall not receive any corrective maintenance, repair, replacement, or adjustment other than that clearly specified as required in the manufacturer's written operation and maintenance manuals as routine and expected during a one-week period. If the continuous monitoring system operates within the specified performance parameters and does not require corrective maintenance, repair, replacement or adjustment other than as specified above during the 168-hour test period, the operational period will be successfully concluded. Failure of the continuous monitoring system to meet this requirement shall call for a repetition of the 168 hour test period. Portions of the test which were satisfactorily completed need not be repeated. Failure to meet any performance specifications shall call for a repetition of the one-week performance test period and that portion of the testing which is related to the failed specification. All maintenance and adjustments required shall be recorded. Output readings shall be recorded before and after all adjustments.

7.2.6 Response Time. Using the data developed under paragraph 6.3, calculate the time interval from concentration switching to 95 percent to the final stable value for all upscale and downscale tests. Report the mean of the three upscale test times and the mean of the three downscale test times. The two average times should not differ by more than 15 percent of the slower time. Report the slower time as the system response time. Record the results on Figure 3-3.

8. References.

8.1 "Performance Specifications for Stationary Source Monitoring Systems for Gases and Visible Emissions," Environmental Protection Agency, Research Triangle Park, N.C., EPA-650/2-74-013, January 1974.

8.2 "Experimental Statistics," Department of Commerce, National Bureau of Standards Handbook 91, 1963, pp. 3-31, paragraphs 3-3.1.4.

(Secs. 111 and 114 of the Clean Air Act, as amended by sec. 4(a) of Pub. L. 91-604, 84 Stat. 1678 (42 U.S.C. 1857c-6, by sec. 15(c)(2) of Pub. L. 91-604, 85 Stat. 1713 (42 U.S.C. 1857g)).

Data Set No.	Time Begin	Time End	Date	Zero Reading	Zero Drift (ΔZero)	Span Reading	Span Drift (ΔSpan)	Calibration Drift (ΔSpan-ΔZero)
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								

Zero Drift = [Mean Zero Drift* ______ + CI (Zero) ______] = ______.

Calibration Drift = [Mean Span Drift* ______ + CI (Span ______] = ______.

*Absolute Value.

Figure 3-1. Zero and Calibration Drift (2 Hour).

Date and Time	Zero Reading	Zero Drift (ΔZero)	Span Reading (After zero adjustment)	Calibration Drift (ΔSpan)

Zero Drift = [Mean Zero Drift* ______ + C.I. (Zero) ______]

= ______.

Calibration Drift = [Mean Span Drift* ______ + C.I. (Span) ______]

= ______.

* Absolute value

Figure 3-2. Zero and Calibration Drift (24-hour)

Date of Test ____________

Span Gas Concentration ________ ppm

Analyzer Span Setting ________ ppm

Upscale
1. ________ seconds
2. ________ seconds
3. ________ seconds

Average upscale response ________ seconds

Downscale
1. ________ seconds
2. ________ seconds
3. ________ seconds

Average downscale response ________ seconds

System average response time (slower time) = ________ seconds

% deviation from slower system average response $= \dfrac{\text{average upscale minus average downscale}}{\text{slower time}} \times 100\%$

= ____________.

Figure 3-3. Response

(Sec. 114 of the Clean Air Act as amended
(42 U.S.C. 1857c-9).). 66

APPENDIX C—DETERMINATION OF EMISSION RATE CHANGE

1. *Introduction.*

1.1 The following method shall be used to determine whether a physical or operational change to an existing facility resulted in an increase in the emission rate to the atmosphere. The method used is the Student's t test, commonly used to make inferences from small samples.

2. *Data.*

2.1 Each emission test shall consist of n runs (usually three) which produce n emission rates. Thus two sets of emission rates are generated, one before and one after the change, the two sets being of equal size.

2.2 When using manual emission tests, except as provided in § 60.8(b) of this part, the reference methods of Appendix A to this part shall be used in accordance with the procedures specified in the applicable subpart both before and after the change to obtain the data.

2.3 When using continuous monitors, the facility shall be operated as if a manual emission test were being performed. Valid data using the averaging time which would be required if a manual emission test were being conducted shall be used.

3. *Procedure.*

3.1 Subscripts a and b denote prechange and postchange respectively.

3.2 Calculate the arithmetic mean emission rate, $\bar{E}$, for each set of data using Equation 1.

$$\bar{E}=\sum_{i=1}^{n}\frac{E_i}{n}=\frac{E_1+E_2\dots+E_n}{n} \qquad (1)$$

where:
E_i=Emission rate for the i th run;
n=number of runs

3.3 Calculate the sample variance, S^2, for each set of data using Equation 2.

$$S^2=\frac{\sum_{i=1}^{n}(E_i-\bar{E})^2}{n-1}=\frac{\sum_{i=1}^{n}E_i^2-\left(\sum_{i=1}^{n}E_i\right)^2/n}{n-1} \qquad (2)$$

3.4 Calculate the pooled estimate, S_p, using Equation 3.

$$S_p=\left[\frac{(n_a-1)S_a^2+(n_b-1)S_b^2}{n_a+n_b-2}\right]^{1/2} \qquad (3)$$

3.5 Calculate the test statistic, t, using Equation 4.

$$t=\frac{\bar{E}_b-\bar{E}_a}{S_p\left[\frac{1}{n_a}+\frac{1}{n_b}\right]^{1/2}} \qquad (4)$$

4. *Results.*

4.1 If $\bar{E}_b>\bar{E}_a$ and $t>t'$, where t' is the critical value of t obtained from Table 1, then with 95% confidence the difference between $\bar{E}_b$ and $\bar{E}_a$ is significant, and an increase in emission rate to the atmosphere has occurred.

TABLE 1

Degrees of freedom (n_a+n_b-2)	t' (95 percent confidence level)
2	2.920
3	2.353
4	2.132
5	2.015
6	1.943
7	1.895
8	1.860

For greater than 8 degrees of freedom, see any standard statistical handbook or text.

4.2 Assume the two performance tests produced the following set of data:

Test a:		Test b
Run 1	100	115
Run 2	95	120
Run 3	110	125

4.3 Using Equation 1—

$$\bar{E}_a=\frac{100+95+110}{3}=102$$

$$\bar{E}_b=\frac{115+120+125}{3}=120$$

4.4 Using Equation 2—

$$S_a^2=\frac{(100-102)^2+(95-102)^2+(110-102)^2}{3-1}=58.5$$

$$S_b^2=\frac{(115-120)^2+(120-120)^2+(125-120)^2}{3-1}=25$$

4.5 Using Equation 3—

$$S_p=\left[\frac{(3-1)(58.5)+(3-1)(25)}{3+3-2}\right]^{1/2}=6.46$$

4.6 Using Equation 4—

$$t=\frac{120-102}{6.46\left[\frac{1}{3}+\frac{1}{3}\right]^{1/2}}=3.412$$

4.7 Since $(n_a+n_b-2)=4$, $t'=2.132$ (from Table 1). Thus since $t>t'$ the difference in the values of $\bar{E}_a$ and $\bar{E}_b$ is significant, and there has been an increase in emission rate to the atmosphere.

5. *Continuous Monitoring Data.*

5.1 Hourly averages from continuous monitoring devices, where available, should be used as data points and the above procedure followed.

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).).

Appendix D—Required Emission Inventory Information

(a) Completed NEDS point source form(s) for the entire plant containing the designated facility, including information on the applicable criteria pollutants. If data concerning the plant are already in NEDS, only that information must be submitted which is necessary to update the existing NEDS record for that plant. Plant and point identification codes for NEDS records shall correspond to those previously assigned in NEDS; for plants not in NEDS, these codes shall be obtained from the appropriate Regional Office.

(b) Accompanying the basic NEDS information shall be the following information on each designated facility:

(1) The state and county identification codes, as well as the complete plant and point identification codes of the designated facility in NEDS. (The codes are needed to match these data with the NEDS data.)

(2) A description of the designated facility including, where appropriate:

(i) Process name.

(ii) Description and quantity of each product (maximum per hour and average per year).

(iii) Description and quantity of raw materials handled for each product (maximum per hour and average per year).

(iv) Types of fuels burned, quantities and characteristics (maximum and average quantities per hour, average per year).

(v) Description and quantity of solid wastes generated (per year) and method of disposal.

(3) A description of the air pollution control equipment in use or proposed to control the designated pollutant, including:

(i) Verbal description of equipment.

(ii) Optimum control efficiency, in percent. This shall be a combined efficiency when more than one device operate in series. The method of control efficiency determination shall be indicated (e.g., design efficiency, measured efficiency, estimated efficiency).

(iii) Annual average control efficiency, in percent, taking into account control equipment down time. This shall be a combined efficiency when more than one device operate in series.

(4) An estimate of the designated pollutant emissions from the designated facility (maximum per hour and average per year). The method of emission determination shall also be specified (e.g., stack test, material balance, emission factor).

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).).

SECTION IV

FULL TEXT
OF
REVISIONS

IV. FULL TEXT OF REVISIONS

Ref.		Page
	36 FR 5931, 3/31/71 - List of Categories of Stationary Sources.	
	36 FR 15704, 8/17/71 - Proposed Standards for Five Categories: Fossil Fuel-Fired Steam Generators, Portland Cement Plants, Nitric Acid Plants, and Sulfuric Acid Plants.	
1.	36 FR 24876, 12/23/71 - Standards of Performance Promulgated for Fossil Fuel-Fired Steam Generators, Incinerators, Portland Cement Plants, Nitric Acid Plants, and Sulfuric Acid Plants.	1
1A.	37 FR 5767, 3/21/72 - Supplemental Statement in Connection with Final Promulgation.	21
2.	37 FR 14877, 7/26/72 - Standard for Sulfur Dioxide; Correction.	25
	37 FR 17214, 8/25/72 - Proposed Standards for Emissions During Startup, Shutdown, and Malfunction.	
3.	38 FR 13562, 5/23/73 - Amendment to Standards for Opacity and Corrections to Certain Test Methods.	26
	38 FR 15406, 6/11/73 - Proposed Standards of Performance for Asphalt Concrete Plants, Petroleum Refineries, Storage Vessels for Petroleum Liquids, Secondary Lead Smelters, Brass and Bronze Ingot Production Plants, Iron and Steel Plants, and Sewage Treatment Plants.	
4.	38 FR 28564, 10/15/73 - Standards of Performance Promulgated for Emissions During Startup, Shutdown, and Malfunction.	26
4A.	38 FR 10820, 5/2/73 - Proposed Standards of Performance for Emissions During Startup, Shutdown, & Malfunction.	28
5.	39 FR 9308, 3/8/74 - Standards of Performance Promulgated for Asphalt Concrete Plants, Petroleum Refineries, Storage Vessels for Petroleum Liquids, Secondary Lead Smelters, Brass and Bronze Ingot Production Plants, Iron and Steel Plants, and Sewage Treatment Plants; and Miscellaneous Amendments.	30

6. 39 FR 13776, 4/17/74 - Corrections to March 8, 1974 Federal Register. 45

7. 39 FR 15396, 5/3/74 - Corrections to March 8, 1974 and April 17, 1974 Federal Register. 46

8. 39 FR 20790, 6/14/74 - Standards of Performance, Miscellaneous Amendments. 46

39 FR 32852, 9/11/74 - Proposed Standards of Performance - Emission Monitoring Requirements and Performance Testing Methods.

39 FR 36102, 10/7/74 - Proposed Standards of Performance for State Plans for the Control of Existing Facilities.

39 FR 36946, 10/15/74 - Proposed Standards of Performance for Modification, Notification, and Reconstruction.

39 FR 37040, 10/16/74 - Proposed Standards of Performance for Primary Copper, Zinc, and Lead Smelters.

39 FR 37470, 10/21/74 - Proposed Standards of Performance for Ferroalloy Production Facilities.

39 FR 37466, 10/21/74 - Proposed Standards of Performance for Steel Plants: Electric Arc Furnaces.

39 FR 37602, 10/22/74 - Proposed Standards of Performance - Five Categories of Sources in the Phosphate Fertilizer Industry.

39 FR 37730, 10/23/74 - Proposed Standards of Performance for Primary Aluminum Reduction Plants.

39 FR 37922, 10/24/74 - Proposed Standards of Performance for Coal Preparation Plants.

9. 39 FR 37987, 10/25/74 - Region V Office: New Address. 51

10. 39 FR 39872, 11/12/74 - Opacity Provisions for New Stationary Sources Promulgated and Appendix A, Method 9 - Visual Determination of the Opacity of Emissions from Stationary Sources. 51

39 FR 39909, 11/12/74 - Response to Remand, Portland Cement Association v. Ruckelshaus, Reevaluation of Standards.

40 FR 831, 1/3/75 - Reevaluation of Opacity Standards of Performance for New Sources - Asphalt Concrete Plants.

11. 40 FR 2803, 1/16/75 - Amended Standard for Coal Refuse (promulgated December 23, 1971). 57

40 FR 17778, 4/22/75 - Standards of Performance, Proposed Opacity Provisions, Request for Public Comment.

12. 40 FR 18169, 4/25/75 - Delegation of Authority to State of Washington. 58

13. 40 FR 26677, 6/25/75 - Delegation of Authority to State of Idaho. 58

14. 40 FR 33152, 8/6/75 - Standards of Performance Promulgated for Five Categories of Sources in the Phosphate Fertilizer Industry. 59

40 FR 39927, 8/29/75 - Standards of Performance for Sulfuric Acid Plants - EPA Response to Remand.

40 FR 41834, 9/9/75 - Opacity Reevaluation - Asphalt Concrete, Response to Public Comments.

40 FR 42028, 9/10/75 - Proposed Opacity Standards for Fossil Fuel-Fired Steam Generators.

40 FR 42045, 9/10/75 - Standards of Performance for Fossil Fuel-Fired Steam Generators - EPA Response to Remand.

15. 40 FR 42194, 9/11/75 - Delegation of Authority to State of California. 74

16. 40 FR 43850, 9/23/75 - Standards of Performance Promulgated for Electric Arc Furnaces in the Steel Industry. 75

17. 40 FR 45170, 10/1/75 - Delegation of Authority to State of California. 80

18. 40 FR 46250, 10/6/75 - Standards of Performance Promulgated for Emission Monitoring Requirements and Revisions to Performance Testing Methods. 81

19. 40 FR 48347, 10/15/75 - Delegation of Authority to State of New York. 102

20. 40 FR 50718, 10/31/75 - Delegation of Authority to State of Colorado. 102

21. 40 FR 53340, 11/17/75 - Standards of Performance, Promulgation of State Plans for the control of Certain Pollutants from Existing Facilities (Subpart B and Appendix D). 103

40 FR 53420, 11/18/75 - Reevaluation of Opacity Standards for Secondary Brass and Bronze Plants and Secondary Lead Smelters.

22. 40 FR 58416, 12/16/75 - Standards of Performance, Promulgation of Modification, Notification and Reconstruction Provisions. 113

23. 40 FR 59204, 12/22/75 - Corrections to October 6, 1975, Federal Register. 118

24. 40 FR 59729, 12/30/75 - Delegation of Authority to State of Maine. 118

25. 41 FR 1913, 1/13/76 - Delegation of Authority to State of Michigan. 119

26. 41 FR 2231, 1/15/76 - Standards of Performance Promulgated for Coal Preparation Plants. 119

26. 41 FR 2332, 1/15/76 - Standards of Performance Promulgated for Primary Copper, Zinc and Lead Smelters. 123

27. 41 FR 3825, 1/26/76 - Standards of Performance Promulgated for Primary Aluminum Reduction Plants. 133

28. 41 FR 4263,1/29/76 - Delegation of Authority to Washington Local Authorities. 138

41 FR 7447, 2/18/76 - Reevaluation of Opacity Standards for Municipal Sewage Sludge Incinerators.

29. 41 FR 7749, 2/20/76 - Delegation of Authority to State of Oregon. 138

30. 41 FR 8346, 2/26/76 - Correction to the Primary Copper, Zinc, and Lead Smelter Standards Promulgated on 1/15/76. 139

31. 41 FR 11820, 3/22/76 - Delegation of Authority to State of Connecticut. 139

32. 41 FR 17549, 4/27/76 - Delegation of Authority to State of South Dakota. 139

33. 41 FR 18498, 5/4/76 - Standards of Performance Promulgated for Ferroalloy Production Facilities. 140

41 FR 19374, 5/12/76 - Revised Public Comment Summary for Modification, Notification, and Reconstruction.

41 FR 19584, 5/12/76 - Phosphate Fertilizer Plants, Draft Guidelines Document - Notice of Availability.

34. 41 FR 19633, 5/13/76 - Delegation of Authority to Commonwealth of Massachusetts and Delegation of Authority to State of New Hampshire. 145

35. 41 FR 20659, 5/20/76 - Correction to Ferroalloy Production Facilities Standards Promulgated on May 4, 1976. 146

36. 41 FR 21450, 5/26/76 - Delegation of Authority to State of California. 146

41 FR 23059, 6/8/76 - Proposed Amendments to Reference Methods 1-8.

37. 41 FR 24124, 6/15/76 - Delegation of Authority to State of Utah. 146

38. 41 FR 24885, 6/21/76 - Delegation of Authority to State of Georgia. 147

39. 41 FR 27967, 7/8/76 - Delegation of Authority to State of California. 147

40. 41 FR 33264, 8/9/76 - Delegation of Authority to State of California. 148

41. 41 FR 34628, 8/16/76 - Delegation of Authority to Virgin Islands. 148

42. 41 FR 35185, 8/20/76 - Revision to Emission Monitoring Requirements. 149

41 FR 36600, 8/30/76 - Proposed Revisions to Standards of Performance for Petroleum Refinery Fluid Catalytic Cracking Unit Catalyst Regenerators.

43. 41 FR 36918, 9/1/76 - Standards of Performance - Availability of Information. 149

44. 41 FR 40107, 9/17/76 - Delegation of Authority to State of California. 149

45. 41 FR 40467, 9/20/76 - Delegation of Authority to State of Alabama. 150

41 FR 42012, 9/24/76 - Proposed Standards of Performance for Kraft Pulp Mills.

46. 41 FR 43148, 9/30/76 - Delegation of Authority to the State State of Indiana. 150

41 FR 43866, 10/4/76 - Proposed Revisions to Standards of Performance for Petroleum Refinery Sulfur Recovery Plants.

47. 41 FR 44859, 10/13/76 - Delegation of Authority to State of North Dakota. 150

41 FR 46618, 10/22/76 - Advanced Notice of Proposed Rulemaking of Air Emission Regulations - Synthetic Organic Chemical Manufacturing Industry.

41 FR 47495, 10/29/76 - Proposed Standards of Performance for Kraft Pulp Mills; Correction.

48. 41 FR 48342, 11/3/76 - Delegation of Authority to State of California. 151

41 FR 48706, 11/4/76 - Proposed Revisions to Emission Guidelines for the Control of Sulfuric Acid Mist from Existing Sulfuric Acid Production Units.

49. 41 FR 51397, 11/22/76 - Amendments to Subpart D Promulgated. 151

41 FR 51621, 11/23/76 - Proposed Standards of Performance for Kraft Pulp Mills - Extension of Comment Period.

41 FR 52079, 11/26/76 - Proposed Revision to Emission Guidelines for the Control of Sulfuric Acid Mist from Existing Sulfuric Acid Production Units; Correction.

50. 41 FR 52299, 11/29/76 - Amendments to Reference Methods 13A and 13B Promulgated. 154

51. 41 FR 53017, 12/3/76 - Delegation of Authority to Pima County Health Department; Arizona. 155

52. 41 FR 54757, 12/15/76 - Delegation of Authority to State of California. 155

53. 41 FR 55531, 12/21/76 - Delegation of Authority to the State of Ohio. 156

41 FR 55792, 12/22/76 - Proposed Revisions to Standards of Performance for Lignite-Fired Steam Generators.

54. 41 FR 56805, 12/30/76 - Delegation of Authority to the States of North Carolina, Nebraska, and Iowa. 156

55. 42 FR 1214, 1/6/77 - Delegation of Authority to State of Vermont. 157

42 FR 2841, 1/13/77 - Proposed Standards of Performance for Grain Elevators.

56. 42 FR 4124, 1/24/77 - Delegation of Authority to the State of South Carolina. 158

42 FR 4863, 1/26/77 - Proposed Revisions to Standards of Performance for Sewage Sludge Incinerators.

42 FR 4883, 1/26/77 - Receipt of Application and Approval of Alternative Test Method. 158

42 FR 5121, 1/27/77 - Notice of Study to Review Standards for Fossil Fuel-Fired Steam Generators; SO_2 Emissions.

57. 42 FR 5936, 1/31/77 - Revisions to Emission Monitoring Requirements and to Reference Methods Promulgated. 159

58. 42 FR 6812, 2/4/77 - Delegation of Authority to City of Philadelphia. 161

42 FR 10019, 2/18/77 - Proposed Standards for Sewage Treatment Plants; Correction.

42 FR 12130, 3/2/77 - Proposed Revision to Standards of Performance for Iron & Steel Plants; Basic Oxygen Process Furnaces.

42 FR 13566, 3/11/77 - Proposed Standards of Performance for Grain Elevators; Extension of Comment Period.

59. 42 FR 16777, 3/30/77 - Correction of Region V Address and Delegation of Authority to the State of Wisconsin. 161

42 FR 18884, 4/11/77 - Notice of Public Hearing on Coal-Fired Steam Generators SO_2 Emissions.

42 FR 22506, 5/3/77 - Proposed Standards of Performance for Lime Manufacturing Plants.

60. 42 FR 26205, 5/23/77 - Revision of Compliance with Standards and Maintenance Requirements. 162

42 FR 26222, 5/23/77 - Proposed Revision of Reference Method 11.

42 FR 32264, 6/24/77 - Suspension of Proposed Standards of Performance for Grain Elevators.

61. 42 FR 32426, 6/24/77 - Revisions to Standards of Performance for Petroleum Refinery Fluid Catalytic Cracking Unit Catalyst Regenerators Promulgated. 162

62. 42 FR 37000, 7/19/77 - Revision and Reorganization of the Units and Abbreviations. 164

42 FR 37213, 7/20/77 - Notice of Intent to Develop Standards of Performance for Glass Melting Furnaces.

63. 42 FR 37386, 7/21/77 - Delegation of Authority to the State of New Jersey. 165

64. 42 FR 37936, 7/25/77 - Applicability Dates Incorporated into Existing Regulations. 165

65. 42 FR 38178, 7/27/77 - Standards of Performance for Petroleum Refinery Fluid Catalytic Cracking Unit Catalyst Regenerators and Units and Measures; Corrections. 168

66. 42 FR 39389, 8/4/77 - Standards of Performance for Petroleum Refinery Fluid Catalytic Cracking Unit Catalyst Regenerators, Correction. 168

67. 42 FR 41122, 8/15/77 - Amendments to Subpart D; Correction. 168

68. 42 FR 41424, 8/17/77 - Authority Citations; Revision 169

69. 42 FR 41754, 8/18/77 - Revision to Reference Methods 1-8 Promulgated. 170

70. 42 FR 44544, 9/6/77 - Delegation of Authority to the State of Montana. 206

71. 42 FR 44812, 9/7/77 - Standards of Performance, Applicability Dates; Correction. 206

42 FR 45705, 9/12/77 - Notice of Delegation of Authority to the State of Indiana.

72. 42 FR 46304, 9/15/77 - Delegation of Authority to the State of Wyoming. 207

[1] Title 40—PROTECTION OF ENVIRONMENT

Chapter I—Environmental Protection Agency

SUBCHAPTER C—AIR PROGRAMS

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

On August 17, 1971 (36 F.R. 15704) pursuant to section 111 of the Clean Air Act as amended, the Administrator proposed standards of performance for steam generators, portland cement plants, incinerators, nitric acid plants, and sulfuric acid plants. The proposed standards, applicable to sources the construction or modification of which was initiated after August 17, 1971, included emission limits for one or more of four pollutants (particulate matter, sulfur dioxide, nitrogen oxides, and sulfuric acid mist) for each source category. The proposal included requirements for performance testing, stack gas monitoring, record keeping and reporting, and procedures by which EPA will provide preconstruction review and determine the applicability of the standards to specific sources.

Interested parties were afforded an opportunity to participate in the rule making by submitting comments. A total of more than 200 interested parties, including Federal, State, and local agencies, citizens groups, and commercial and industrial organizations submitted comments. Following a review of the proposed regulations and consideration of the comments, the regulations, including the appendix, have been revised and are being promulgated today. The principal revisions are described below:

1. Particulate matter performance testing procedures have been revised to eliminate the requirement for impingers in the sampling train. Compliance will be based only on material collected in the dry filter and the probe preceding the filter. Emission limits have been adjusted as appropriate to reflect the change in test methods. The adjusted standards require the same degree of particulate control as the originally proposed standards.

2. Provisions have been added whereby alternative test methods can be used to determine compliance. Any person who proposes the use of an alternative method will be obliged to provide evidence that the alternative method is equivalent to the reference method.

3. The definition of modification, as it pertains to increases in production rate and changes of fuels, has been clarified. Increases in production rates up to design capacity will not be considered a modification nor will fuel switches if the equipment was originally designed to accommodate such fuels. These provisions will eliminate inequities where equipment had been put into partial operation prior to the proposal of the standards.

4. The definition of a new source was clarified to include construction which is completed within an organization as well as the more common situations where the facility is designed and constructed by a contractor.

5. The provisions regarding requests for EPA plan review and determination of construction or modification have been modified to emphasize that the submittal of such requests and attendant information is purely voluntary. Submittal of such a request will not bind the operator to supply further information; however, lack of sufficient information may prevent the Administrator from rendering an opinion. Further provisions have been added to the effect that information submitted voluntarily for such plan review or determination of applicability will be considered confidential, if the owner or operator requests such confidentiality.

6. Requirements for notifying the Administrator prior to commencing construction have been deleted. As proposed, the provision would have required notification prior to the signing of a contract for construction of a new source. Owners and operators still will be required to notify the Administrator 30 days prior to initial operation and to confirm the action within 15 days after startup.

7. Revisions were incoporated to permit compliance testing to be deferred up to 60 days after achieving the maximum production rate but no longer than 180 days after initial startup. The proposed regulation could have required testing within 60 days after startup but defined startup as the beginning of routine operation. Owners or operators will be required to notify the Administrator at least 10 days prior to compliance testing so that an EPA observer can be on hand. Procedures have been modified so that the equipment will have to be operated at maximum expected production rate, rather than rated capacity, during compliance tests.

8. The criteria for evaluating performance testing results have been simplified to eliminate the requirement that all values be within 35 percent of the average. Compliance will be based on the average of three repetitions conducted in the specified manner.

9. Provisions were added to require owners or operators of affected facilities to maintain records of compliance tests, monitoring equipment, pertinent analyses, feed rates, production rates, etc. for 2 years and to make such information available on request to the Administrator. Owners or operators will be required to summarize the recorded data daily and to convert recorded data into the applicable units of the standard.

10. Modifications were made to the visible emission standards for steam generators, cement plants, nitric acid plants, and sulfuric acid plants. The Ringelmann standards have been deleted; all limits will be based on opacity. In every case, the equivalent opacity will be at least as stringent as the proposed Ringelmann number. In addition, requirements have been altered for three of the source categories so that allowable emissions will be less than 10 percent opacity rather than 5 percent or less opacity. There were many comments that observers could not accurately evaluate emissions of 5 percent opacity. In addition, drafting errors in the proposed visible emission limits for cement kilns and steam generators were corrected. Steam generators will be limited to visible emissions not greater than 20 percent opacity and cement kilns to not greater than 10 percent opacity.

11. Specifications for monitoring devices were clarified, and directives for calibration were included. The instruments are to be calibrated at least once a day, or more often if specified by the manufacturer. Additional guidance on the selection and use of such instruments will be provided at a later date.

12. The requirement for sulfur dioxide monitoring at steam generators was deleted for those sources which will achieve the standard by burning low-sulfur fuel, provided that fuel analysis is conducted and recorded daily. American Society for Testing and Materials sampling techniques are specified for coal and fuel oil.

13. Provisions were added to the steam generator standards to cover those instances where mixed fuels are burned. Allowable emissions will be determined by prorating the heat input of each fuel; however, in the case of sulfur dioxide, the provisions allow operators the option of burning low-sulfur fuels (probably natural gas) as a means of compliance.

14. Steam generators fired with lignite have been exempted from the nitrogen oxides limit. The revision was made in view of the lack of information on some types of lignite burning. When more information is developed, nitrogen oxides standards may be extended to lignite fired steam generators.

15. A provision was added to make it explicit that the sulfuric acid plant standards will not apply to scavenger acid plants. As stated in the background document, APTD 0711, which was issued at the time the proposed standards were published, the standards were not meant to apply to such operations, e.g., where sulfuric acid plants are used primarily to control sulfur dioxide or other sulfur compounds which would otherwise be vented into the atmosphere.

16. The regulation has been revised to provide that all materials submitted pursuant to these regulations will be directed to EPA's Office of General Enforcement.

17. Several other technical changes have also been made. States and interested parties are urged to make a careful reading of these regulations.

As required by section 111 of the Act, the standards of performance promulgated herein "reflect the degree of emission reduction which (taking into account the cost of achieving such reduction) the Administrator determines has been adequately demonstrated". The standards of performance are based on stationary source testing conducted by the Environmental Protection Agency and/or contractors and on data derived from various other sources, including the available technical literature. In the comments on the proposed standards, many questions were raised as to costs and demonstrated capability of control systems to meet the standards. These comments have been evaluated and investigated, and it is the Administrator's judgment that emission control systems capable of meeting the standards have been adequately demonstrated and that the standards promulgated herein are achievable at reasonable costs.

The regulations establishing standards of performance for steam generators, incinerators, cement plants, nitric acid plants, and sulfuric acid plants are hereby promulgated effective on publication and apply to sources, the construction or modification of which was commenced after August 17, 1971.

Dated: December 16, 1971.

William D. Ruckelshaus,
Administrator,
Environmental Protection Agency.

A new Part 60 is added to Chapter I, Title 40, Code of Federal Regulations, as follows:

Subpart A—General Provisions

Sec.
60.1 Applicability.
60.2 Definitions.
60.3 Abbreviations.
60.4 Address.
60.5 Determination of construction or modification.
60.6 Review of plans.
60.7 Notification and recordkeeping.
60.8 Performance tests.
60.9 Availability of information.
60.10 State authority.

Subpart D—Standards of Performance for Fossil Fuel-Fired Steam Generators

60.40 Applicability and designation of affected facility.
60.41 Definitions.
60.42 Standard for particulate matter.
60.43 Standard for sulfur dioxide.
60.44 Standard for nitrogen oxides.
60.45 Emission and fuel monitoring.
60.46 Test methods and procedures.

Subpart E—Standards of Performance for Incinerators

60.50 Applicability and designation of affected facility.
60.51 Definitions.
60.52 Standard for particulate matter.
60.53 Monitoring of operations.
60.54 Test methods and procedures.

Subpart F—Standards of Performance for Portland Cement Plants

60.60 Applicability and designation of affected facility.
60.61 Definitions.
60.62 Standard for particulate matter.
60.63 Monitoring of operations.
60.64 Test methods and procedures.

Subpart G—Standards of Performance for Nitric Acid Plants

60.70 Applicability and designation of affected facility.
60.71 Definitions.
60.72 Standard for nitrogen oxides.
60.73 Emission monitoring.
60.74 Test methods and procedures.

Subpart H—Standards of Performance for Sulfuric Acid Plants

60.80 Applicability and designation of affected facility.
60.81 Definitions.

Sec.
60.82 Standard for sulfur dioxide.
60.83 Standard for acid mist.
60.84 Emission monitoring.
60.85 Test methods and procedures.

Appendix—Test Methods

Method 1—Sample and velocity traverses for stationary sources.
Method 2—Determination of stack gas velocity and volumetric flow rate (Type S pitot tube).
Method 3—Gas analysis for carbon dioxide, excess air, and dry molecular weight.
Method 4—Determination of moisture in stack gases.
Method 5—Determination of particulate emissions from stationary sources.
Method 6—Determination of sulfur dioxide emissions from stationary sources.
Method 7—Determination of nitrogen oxide emissions from stationary sources.
Method 8—Determination of sulfuric acid mist and sulfur dioxide emissions from stationary sources.
Method 9—Visual determination of the opacity of emissions from stationary sources.

Authority: The provisions of this Part 60 issued under sections 111, 114, Clean Air Act; Public Law 91-604, 84 Stat. 1713.

Subpart A—General Provisions

§ 60.1 Applicability.

The provisions of this part apply to the owner or operator of any stationary source, which contains an affected facility the construction or modification of which is commenced after the date of publication in this part of any proposed standard applicable to such facility.

§ 60.2 Definitions.

As used in this part, all terms not defined herein shall have the meaning given them in the Act:

(a) "Act" means the Clean Air Act (42 U.S.C. 1857 et seq., as amended by Public Law 91-604, 84 Stat. 1676).

(b) "Administrator" means the Administrator of the Environmental Protection Agency or his authorized representative.

(c) "Standard" means a standard of performance proposed or promulgated under this part.

(d) "Stationary source" means any building, structure, facility, or installation which emits or may emit any air pollutant.

(e) "Affected facility" means, with reference to a stationary source, any apparatus to which a standard is applicable.

(f) "Owner or operator" means any person who owns, leases, operates, controls, or supervises an affected facility or a stationary source of which an affected facility is a part.

(g) "Construction" means fabrication, erection, or installation of an affected facility.

(h) "Modification" means any physical change in, or change in the method of operation of, an affected facility which increases the amount of any air pollutant (to which a standard applies) emitted by such facility or which results in the emission of any air pollutant (to which a standard applies) not previously emitted, except that:

(1) Routine maintenance, repair, and replacement shall not be considered physical changes, and

(2) The following shall not be considered a change in the method of operation:

(i) An increase in the production rate, if such increase does not exceed the operating design capacity of the affected facility;

(ii) An increase in hours of operation;

(iii) Use of an alternative fuel or raw material if, prior to the date any standard under this part becomes applicable to such facility, as provided by § 60.1, the affected facility is designed to accommodate such alternative use.

(i) "Commenced" means that an owner or operator has undertaken a continuous program of construction or modification or that an owner or operator has entered into a binding agreement or contractual obligation to undertake and complete, within a reasonable time, a continuous program of construction or modification.

(j) "Opacity" means the degree to which emissions reduce the transmission of light and obscure the view of an object in the background.

(k) "Nitrogen oxides" means all oxides of nitrogen except nitrous oxide, as measured by test methods set forth in this part.

(l) "Standard of normal conditions" means 70° Fahrenheit (21.1° centigrade) and 29.92 in. Hg (760 mm. Hg).

(m) "Proportional sampling" means sampling at a rate that produces a constant ratio of sampling rate to stack gas flow rate.

(n) "Isokinetic sampling" means sampling in which the linear velocity of the gas entering the sampling nozzle is equal to that of the undisturbed gas stream at the sample point.

(o) "Startup" means the setting in operation of an affected facility for any purpose.

§ 60.3 Abbreviations.

The abbreviations used in this part have the following meanings in both capital and lower case:

B.t.u.—British thermal unit.
cal.—calorie(s).
c.f.m.—cubic feet per minute.
CO_2—carbon dioxide.
g.—gram(s).
gr.—grain(s).
mg.—milligram(s).
mm.—millimeter(s).
l.—liter(s).
nm.—nanometer(s), —10^{-9} meter.
μg.—microgram(s), 10^{-6} gram.
Hg.—mercury.
in.—inch(es).
K—1,000.
lb.—pound(s).
ml.—milliliter(s).
No.—number.
%—percent.
NO—nitric oxide.
NO_2—nitrogen dioxide.
NO_x—nitrogen oxides.
NM^3—normal cubic meter.
s.c.f.—standard cubic feet.
SO_2—sulfur dioxide.
H_2SO_4—sulfuric acid.
SO_3—sulfur trioxide.

ft.^{3}—cubic feet.
ft.^{2}—square feet.
min.—minute(s).
hr.—hour(s).

§ 60.4 Address.

All applications, requests, submissions, and reports under this part shall be submitted in triplicate and addressed to the Environmental Protection Agency, Office of General Enforcement, Waterside Mall SW., Washington, DC 20460.

§ 60.5 Determination of construction or modification.

When requested to do so by an owner or operator, the Administrator will make a determination of whether actions taken or intended to be taken by such owner or operator constitute construction or modification or the commencement thereof within the meaning of this part.

§ 60.6 Review of plans.

(a) When requested to do so by an owner or operator, the Administrator will review plans for construction or modification for the purpose of providing technical advice to the owner or operator.

(b) (1) A separate request shall be submitted for each affected facility.

(2) Each request shall (i) identify the location of such affected facility, and (ii) be accompanied by technical information describing the proposed nature, size, design, and method of operation of such facility, including information on any equipment to be used for measurement or control of emissions.

(c) Neither a request for plans review nor advice furnished by the Administrator in response to such request shall (1) relieve an owner or operator of legal responsibility for compliance with any provision of this part or of any applicable State or local requirement, or (2) prevent the Administrator from implementing or enforcing any provision of this part or taking any other action authorized by the Act.

§ 60.7 Notification and record keeping.

(a) Any owner or operator subject to the provisions of this part shall furnish the Administrator written notification as follows:

(1) A notification of the anticipated date of initial startup of an affected facility not more than 60 days or less than 30 days prior to such date.

(2) A notification of the actual date of initial startup of an affected facility within 15 days after such date.

(b) Any owner or operator subject to the provisions of this part shall maintain for a period of 2 years a record of the occurrence and duration of any startup, shutdown, or malfunction in operation of any affected facility.

§ 60.8 Performance tests.

(a) Within 60 days after achieving the maximum production rate at which the affected facility will be operated, but not later than 180 days after initial startup of such facility and at such other times as may be required by the Administrator under section 114 of the Act, the owner or operator of such facility shall conduct performance test(s) and furnish the Administrator a written report of the results of such performance test(s).

(b) Performance tests shall be conducted and results reported in accordance with the test method set forth in this part or equivalent methods approved by the Administrator; or where the Administrator determines that emissions from the affected facility are not susceptible of being measured by such methods, the Administrator shall prescribe alternative test procedures for determining compliance with the requirements of this part.

(c) The owner or operator shall permit the Administrator to conduct performance tests at any reasonable time, shall cause the affected facility to be operated for purposes of such tests under such conditions as the Administrator shall specify based on representative performance of the affected facility, and shall make available to the Administrator such records as may be necessary to determine such performance.

(d) The owner or operator of an affected facility shall provide the Administrator 10 days prior notice of the performance test to afford the Administrator the opportunity to have an observer present.

(e) The owner or operator of an affected facility shall provide, or cause to be provided, performance testing facilities as follows:

(1) Sampling ports adequate for test methods applicable to such facility.

(2) Safe sampling platform(s).

(3) Safe access to sampling platform (s).

(4) Utilities for sampling and testing equipment.

(f) Each performance test shall consist of three repetitions of the applicable test method. For the purpose of determining compliance with an applicable standard of performance, the average of results of all repetitions shall apply.

§ 60.9 Availability of information.

(a) Emission data provided to, or otherwise obtained by, the Administrator in accordance with the provisions of this part shall be available to the public.

(b) Except as provided in paragraph (a) of this section, any records, reports, or information provided to, or otherwise obtained by, the Administrator in accordance with the provisions of this part shall be available to the public, except that (1) upon a showing satisfactory to the Administrator by any person that such records, reports, or information, or particular part thereof (other than emission data), if made public, would divulge methods or processes entitled to protection as trade secrets of such person, the Administrator shall consider such records, reports, or information, or particular part thereof, confidential in accordance with the purposes of section 1905 of title 18 of the United States Code, except that such records, reports, or information, or particular part thereof, may be disclosed to other officers, employees, or authorized representatives of the United States concerned with carrying out the provisions of the Act or when relevant in any proceeding under the Act; and (2) information received by the Administrator solely for the purposes of §§ 60.5 and 60.6 shall not be disclosed if it is identified by the owner or operator as being a trade secret or commercial or financial information which such owner or operator considers confidential.

§ 60.10 State authority.

The provisions of this part shall not be construed in any manner to preclude any State or political subdivision thereof from:

(a) Adopting and enforcing any emission standard or limitation applicable to an affected facility, provided that such emission standard or limitation is not less stringent than the standard applicable to such facility.

(b) Requiring the owner or operator of an affected facility to obtain permits, licenses, or approvals prior to initiating construction, modification, or operation of such facility.

Subpart D—Standards of Performance for Fossil-Fuel Fired Steam Generators

§ 60.40 Applicability and designation of affected facility.

The provisions of this subpart are applicable to each fossil fuel-fired steam generating unit of more than 250 million B.t.u. per hour heat input, which is the affected facility.

§ 60.41 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act, and in Subpart A of this part.

(a) "Fossil fuel-fired steam generating unit" means a furnace or boiler used in the process of burning fossil fuel for the primary purpose of producing steam by heat transfer.

(b) "Fossil fuel" means natural gas, petroleum, coal and any form of solid, liquid, or gaseous fuel derived from such materials.

(c) "Particulate matter" means any finely divided liquid or solid material, other than uncombined water, as measured by Method 5.

§ 60.42 Standard for particulate matter.

On and after the date on which the performance test required to be conducted by § 60.8 is initiated no owner or operator subject to the provisions of this part shall discharge or cause the discharge into the atmosphere of particulate matter which is:

(a) In excess of 0.10 lb. per million B.t.u. heat input (0.18 g. per million cal.) maximum 2-hour average.

(b) Greater than 20 percent opacity, except that 40 percent opacity shall be permissible for not more than 2 minutes in any hour.

(c) Where the presence of uncombined water is the only reason for failure to meet the requirements of paragraph (b) of this section such failure shall not be a violation of this section.

§ 60.43 Standard for sulfur dioxide.

On and after the date on which the performance test required to be conducted by § 60.8 is initiated no owner or operator subject to the provisions of this part shall discharge or cause the discharge into the atmosphere of sulfur dioxide in excess of:

(a) 0.80 lb. per million B.t.u. heat input (1.4 g. per million cal.), maximum 2-hour average, when liquid fossil fuel is burned.

(b) 1.2 lbs. per million B.t.u. heat input (2.2 g. per million cal.), maximum 2-hour average, when solid fossil fuel is burned.

(c) Where different fossil fuels are burned simultaneously in any combination, the applicable standard shall be determined by proration. Compliance shall be determined using the following formula:

$$\frac{y(0.80)+z(1.2)}{x+y+z}$$

where:
x is the percent of total heat input derived from gaseous fossil fuel and,
y is the percent of total heat input derived from liquid fossil fuel and,
z is the percent of total heat input derived from solid fossil fuel.

§ 60.44 Standard for nitrogen oxides.

On and after the date on which the performance test required to be conducted by § 60.8 is initiated no owner or operator subject to the provisions of this part shall discharge or cause the discharge into the atmosphere of nitrogen oxides in excess of:

(a) 0.20 lb. per million B.t.u. heat input (0.36 g. per million cal.), maximum 2-hour average, expressed as NO_2, when gaseous fossil fuel is burned.

(b) 0.30 lb. per million B.t.u. heat input (0.54 g. per million cal.), maximum 2-hour average, expressed as NO_2, when liquid fossil fuel is burned.

(c) 0.70 lb. per million B.t.u. heat input (1.26 g. per million cal.), maximum 2-hour average, expressed as NO_2 when solid fossil fuel (except lignite) is burned.

(d) When different fossil fuels are burned simultaneously in any combination the applicable standard shall be determined by proration. Compliance shall be determined by using the following formula:

$$\frac{x(0.20)+y(0.30)+z(0.70)}{x+y+z}$$

where:
x is the percent of total heat input derived from gaseous fossil fuel and,
y is the percent of total heat input derived from liquid fossil fuel and,
z is the percent of total heat input derived from solid fossil fuel.

§ 60.45 Emission and fuel monitoring.

(a) There shall be installed, calibrated, maintained, and operated, in any fossil fuel-fired steam generating unit subject to the provisions of this part, emission monitoring instruments as follows:

(1) A photoelectric or other type smoke detector and recorder, except where gaseous fuel is the only fuel burned.

(2) An instrument for continuously monitoring and recording sulfur dioxide emissions, except where gaseous fuel is the only fuel burned, or where compliance is achieved through low sulfur fuels and representative sulfur analysis of fuels are conducted daily in accordance with paragraph (c) or (d) of this section.

(3) An instrument for continuously monitoring and recording emissions of nitrogen oxides.

(b) Instruments and sampling systems installed and used pursuant to this section shall be capable of monitoring emission levels within ±20 percent with a confidence level of 95 percent and shall be calibrated in accordance with the method(s) prescribed by the manufacturer(s) of such instruments; instruments shall be subjected to manufacturers recommended zero adjustment and calibration procedures at least once per 24-hour operating period unless the manufacturer(s) specifies or recommends calibration at shorter intervals, in which case such specifications or recommendations shall be followed. The applicable method specified in the appendix of this part shall be the reference method.

(c) The sulfur content of solid fuels, as burned, shall be determined in accordance with the following methods of the American Society for Testing and Materials.

(1) Mechanical sampling by Method D 2234065.

(2) Sample preparation by Method D 2013-65.

(3) Sample analysis by Method D 271-68.

(d) The sulfur content of liquid fuels, as burned, shall be determined in accordance with the American Society for Testing and Materials Methods D 1551-68, or D 129-64, or D 1552-64.

(e) The rate of fuel burned for each fuel shall be measured daily or at shorter intervals and recorded. The heating value and ash content of fuels shall be ascertained at least once per week and recorded. Where the steam generating unit is used to generate electricity, the average electrical output and the minimum and maximum hourly generation rate shall be measured and recorded daily.

(f) The owner or operator of any fossil fuel-fired steam generating unit subject to the provisions of this part shall maintain a file of all measurements required by this part. Appropriate measurements shall be reduced to the units of the applicable standard daily, and summarized monthly. The record of any such measurement(s) and summary shall be retained for at least 2 years following the date of such measurements and summaries.

§ 60.46 Test methods and procedures.

(a) The provisions of this section are applicable to performance tests for determining emissions of particulate matter, sulfur dioxide, and nitrogen oxides from fossil fuel-fired steam generating units.

(b) All performance tests shall be conducted while the affected facility is operating at or above the maximum steam production rate at which such facility will be operated and while fuels or combinations of fuels representative of normal operation are being burned and under such other relevant conditions as the Administrator shall specify based on representative performance of the affected facility.

(c) Test methods set forth in the appendix to this part or equivalent methods approved by the Administrator shall be used as follows:

(1) For each repetition, the average concentration of particulate matter shall be determined by using Method 5. Traversing during sampling by Method 5 shall be according to Method 1. The minimum sampling time shall be 2 hours, and minimum sampling volume shall be 60 $ft.^3$ corrected to standard conditions on a dry basis.

(2) For each repetition, the SO_2 concentration shall be determined by using Method 6. The sampling site shall be the same as for determining volumetric flow rate. The sampling point in the duct shall be at the centroid of the cross section if the cross sectional area is less than 50 $ft.^2$ or at a point no closer to the walls than 3 feet if the cross sectional area is 50 $ft.^2$ or more. The sample shall be extracted at a rate proportional to the gas velocity at the sampling point. The minimum sampling time shall be 20 min. and minimum sampling volume shall be 0.75 $ft.^3$ corrected to standard conditions. Two samples shall constitute one repetition and shall be taken at 1-hour intervals.

(3) For each repetition the NO_x concentration shall be determined by using Method 7. The sampling site and point shall be the same as for SO_2. The sampling time shall be 2 hours, and four samples shall be taken at 30-minute intervals.

(4) The volumetric flow rate of the total effluent shall be determined by using Method 2 and traversing according to Method 1. Gas analysis shall be performed by Method 3, and moisture content shall be determined by the condenser technique of Method 5.

(d) Heat input, expressed in B.t.u. per hour, shall be determined during each 2-hour testing period by suitable fuel flow meters and shall be confirmed by a material balance over the steam generation system.

(e) For each repetition, emissions, expressed in lb./10^6 B.t.u. shall be determined by dividing the emission rate in lb./hr. by the heat input. The emission rate shall be determined by the equation, lb./hr.$=Q_s \times c$ where, Q_s=volumetric flow rate of the total effluent in $ft.^3$/hr. at standard conditions, dry basis, as determined in accordance with paragraph (c)(4) of this section.

(1) For particulate matter, c=particulate concentration in lb./$ft.^3$, as determined in accordance with paragraph (c)(1) of this section, corrected to standard conditions, dry basis.

(2) For SO_2, c=SO_2 concentration in lb./ft.^{3}, as determined in accordance with paragraph (c)(2) of this section, corrected to standard conditions, dry basis.

(3) For NO_x, c=NO_x concentration in lb./ft.^{3}, as determined in accordance with paragraph (c)(3) of this section, corrected to standard conditions, dry basis.

Subpart E—Standards of Performance for Incinerators

§ 60.50 Applicability and designation of affected facility.

The provisions of this subpart are applicable to each incinerator of more than 50 tons per day charging rate, which is the affected facility.

§ 60.51 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in Subpart A of this part.

(a) "Incinerator" means any furnace used in the process of burning solid waste for the primary purpose of reducing the volume of the waste by removing combustible matter.

(b) "Solid waste" means refuse, more than 50 percent of which is municipal type waste consisting of a mixture of paper, wood, yard wastes, food wastes, plastics, leather, rubber, and other combustibles, and noncombustible materials such as glass and rock.

(c) "Day" means 24 hours.

(d) "Particulate matter" means any finely divided liquid or solid material, other than uncombined water, as measured by Method 5.

§ 60.52 Standard for particulate matter.

On and after the date on which the performance test required to be conducted by § 60.8 is initiated, no owner or operator subject to the provisions of this part shall discharge or cause the discharge into the atmosphere of particulate matter which is in excess of 0.08 gr./s.c.f. (0.18 g./NM^3) corrected to 12 percent CO_2, maximum 2-hour average.

§ 60.53 Monitoring of operations.

The owner or operator of any incinerator subject to the provisions of this part shall maintain a file of daily burning rates and hours of operation and any particulate emission measurements. The burning rates and hours of operation shall be summarized monthly. The record(s) and summary shall be retained for at least 2 years following the date of such records and summaries.

§ 60.54 Test methods and procedures.

(a) The provisions of this section are applicable to performance tests for determining emissions of particulate matter from incinerators.

(b) All performance tests shall be conducted while the affected facility is operating at or above the maximum refuse charging rate at which such facility will be operated and the solid waste burned shall be representative of normal operation and under such other relevant conditions as the Administrator shall specify based on representative performance of the affected facility.

(c) Test methods set forth in the appendix to this part or equivalent methods approved by the Administrator shall be used as follows:

(1) For each repetition, the average concentration of particulate matter shall be determined by using Method 5. Traversing during sampling by Method 5 shall be according to Method 1. The minimum sampling time shall be 2 hours and the minimum sampling volume shall be 60 ft.^{3} corrected to standard conditions on a dry basis.

(2) Gas analysis shall be performed using the integrated sample technique of Method 3, and moisture content shall be determined by the condenser technique of Method 5. If a wet scrubber is used, the gas analysis sample shall reflect flue gas conditions after the scrubber, allowing for the effect of carbon dioxide absorption.

(d) For each repetition particulate matter emissions, expressed in gr./s.c.f., shall be determined in accordance with paragraph (c)(1) of this section corrected to 12 percent CO_2, dry basis.

Subpart F—Standards of Performance for Portland Cement Plants

§ 60.60 Applicability and designation of affected facility.

The provisions of the subpart are applicable to the following affected facilities in portland cement plants: kiln, clinker cooler, raw mill system, finish mill system, raw mill dryer, raw material storage, clinker storage, finished product storage, conveyor transfer points, bagging and bulk loading and unloading systems.

§ 60.61 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in Subpart A of this part.

(a) "Portland cement plant" means any facility manufacturing portland cement by either the wet or dry process.

(b) "Particulate matter" means any finely divided liquid or solid material, other than uncombined water, as measured by Method 5.

§ 60.62 Standard for particulate matter.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is initiated no owner or operator subject to the provisions of this part shall discharge or cause the discharge into the atmosphere of particulate matter from the kiln which is:

(1) In excess of 0.30 lb. per ton of feed to the kiln (0.15 Kg. per metric ton), maximum 2-hour average.

(2) Greater than 10 percent opacity, except that where the presence of uncombined water is the only reason for failure to meet the requirements for this subparagraph, such failure shall not be a violation of this section.

(b) On and after the date on which the performance test required to be conducted by § 60.8 is initiated no owner or operator subject to the provisions of this part shall discharge or cause the discharge into the atmosphere of particulate matter from the clinker cooler which is:

(1) In excess of 0.10 lb. per ton of feed to the kiln (0.050 Kg. per metric ton) maximum 2-hour average.

(2) 10 percent opacity or greater.

(c) On and after the date on which the performance test required to be conducted by § 60.8 is initiated no owner or operator subject to the provisions of this part shall discharge or cause the discharge into the atmosphere of particulate matter from any affected facility other than the kiln and clinker cooler which is 10 percent opacity or greater.

§ 60.63 Monitoring of operations.

The owner or operator of any portland cement plant subject to the provisions of this part shall maintain a file of daily production rates and kiln feed rates and any particulate emission measurements. The production and feed rates shall be summarized monthly. The record(s) and summary shall be retained for at least 2 years following the date of such records and summaries.

§ 60.64 Test methods and procedures.

(a) The provisions of this section are applicable to performance tests for determining emissions of particulate matter from portland cement plant kilns and clinker coolers.

(b) All performance tests shall be conducted while the affected facility is operating at or above the maximum production rate at which such facility will be operated and under such other relevant conditions as the Administrator shall specify based on representative performance of the affected facility.

(c) Test methods set forth in the appendix to this part or equivalent methods approved by the Administrator shall be used as follows:

(1) For each repetition, the average concentration of particulate matter shall be determined by using Method 5. Traversing during sampling by Method 5 shall be according to Method 1. The minimum sampling time shall be 2 hours and the minimum sampling volume shall be 60 ft.^{3} corrected to standard conditions on a dry basis.

(2) The volumetric flow rate of the total effluent shall be determined by using Method 2 and traversing according to Method 1. Gas analysis shall be performed using the integrated sample technique of Method 3, and moisture content shall be determined by the condenser technique of Method 5.

(d) Total kiln feed (except fuels), expressed in tons per hour on a dry basis, shall be determined during each 2-hour testing period by suitable flow meters and shall be confirmed by a material balance over the production system.

(e) For each repetition, particulate matter emissions, expressed in lb./ton of kiln feed shall be determined by dividing the emission rate in lb./hr. by the kiln feed. The emission rate shall be determined by the equation, lb./hr.=$Q_s \times c$, where Q_s=volumetric flow rate of the total effluent in ft.^{3}/hr. at standard conditions, dry basis, as determined in accordance with paragraph (c)(2) of this section, and, c=particulate concentration in lb./ft.^{3}, as determined in accordance with paragraph (c)(1) of this section, corrected to standard conditions, dry basis.

Subpart G—Standards of Performance for Nitric Acid Plants

§ 60.70 Applicability and designation of affected facility.

The provisions of this subpart are applicable to each nitric acid production unit, which is the affected facility.

§ 60.71 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in Subpart A of this part.

(a) "Nitric acid production unit" means any facility producing weak nitric acid by either the pressure or atmospheric pressure process.

(b) "Weak nitric acid" means acid which is 30 to 70 percent in strength.

§ 60.72 Standard for nitrogen oxides.

On and after the date on which the performance test required to be conducted by § 60.8 is initiated no owner or operator subject to the provisions of this part shall discharge or cause the discharge into the atmosphere of nitrogen oxides which are:

(a) In excess of 3 lbs. per ton of acid produced (1.5 kg. per metric ton), maximum 2-hour average, expressed as NO_2.

(b) 10 percent opacity or greater.

§ 60.73 Emission monitoring.

(a) There shall be installed, calibrated, maintained, and operated, in any nitric acid production unit subject to the provisions of this subpart, an instrument for continuously monitoring and recording emissions of nitrogen oxides.

(b) The instrument and sampling system installed and used pursuant to this section shall be capable of monitoring emission levels within ±20 percent with a confidence level of 95 percent and shall be calibrated in accordance with the method(s) prescribed by the manufacturer(s) of such instrument, the instrument shall be subjected to manufacturers recommended zero adjustment and calibration procedures at least once per 24-hour operating period unless the manufacturer(s) specifies or recommends calibration at shorter intervals, in which case such specifications or recommendations shall be followed. The applicable method specified in the appendix of this part shall be the reference method.

(c) Production rate and hours of operation shall be recorded daily.

(d) The owner or operator of any nitric acid production unit subject to the provisions of this part shall maintain a file of all measurements required by this subpart. Appropriate measurements shall be reduced to the units of the standard daily and summarized monthly. The record of any such measurement and summary shall be retained for at least 2 years following the date of such measurements and summaries.

§ 60.74 Test methods and procedures.

(a) The provisions of this section are applicable to performance tests for determining emissions of nitrogen oxides from nitric acid production units.

(b) All performance tests shall be conducted while the affected facility is operating at or above the maximum acid production rate at which such facility will be operated and under such other relevant conditions as the Administrator shall specify based on representative performance of the affected facility.

(c) Test methods set forth in the appendix to this part or equivalent methods as approved by the Administrator shall be used as follows:

(1) For each repetition the NO_x concentration shall be determined by using Method 7. The sampling site shall be selected according to Method 1 and the sampling point shall be the centroid of the stack or duct. The sampling time shall be 2 hours and four samples shall be taken at 30-minute intervals.

(2) The volumetric flow rate of the total effluent shall be determined by using Method 2 and traversing according to Method 1. Gas analysis shall be performed by using the integrated sample technique of Method 3, and moisture content shall be determined by Method 4.

(d) Acid produced, expressed in tons per hour of 100 percent nitric acid, shall be determined during each 2-hour testing period by suitable flow meters and shall be confirmed by a material balance over the production system.

(e) For each repetition, nitrogen oxides emissions, expressed in lb./ton of 100 percent nitric acid, shall be determined by dividing the emission rate in lb./hr. by the acid produced. The emission rate shall be determined by the equation, $lb./hr.=Q_s \times c$, where Q_s=volumetric flow rate of the effluent in ft.^{3}/hr. at standard conditions, dry basis, as determined in accordance with paragraph (c)(2) of this section, and $c=NO_x$ concentration in lb./ft.^{3}, as determined in accordance with paragraph (c)(1) of this section, corrected to standard conditions, dry basis.

Subpart H—Standards of Performance for Sulfuric Acid Plants

§ 60.80 Applicability and designation of affected facility.

The provisions of this subpart are applicable to each sulfuric acid production unit, which is the affected facility.

§ 60.81 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in Subpart A of this part.

(a) "Sulfuric acid production unit" means any facility producing sulfuric acid by the contact process by burning elemental sulfur, alkylation acid, hydrogen sulfide, organic sulfides and mercaptans, or acid sludge, but does not include facilities where conversion to sulfuric acid is utilized primarily as a means of preventing emissions to the atmosphere of sulfur dioxide or other sulfur compounds.

(b) "Acid mist" means sulfuric acid mist, as measured by test methods set forth in this part.

§ 60.82 Standard for sulfur dioxide.

On and after the date on which the performance test required to be conducted by § 60.8 is initiated no owner or operator subject to the provisions of this part shall discharge or cause the discharge into the atmosphere of sulfur dioxide in excess of 4 lbs. per ton of acid produced (2 kg. per metric ton), maximum 2-hour average.

§ 60.83 Standard for acid mist.

On and after the date on which the performance test required to be conducted by § 60.8 is initiated no owner or operator subject to the provisions of this part shall discharge or cause the discharge into the atmosphere of acid mist which is:

(a) In excess of 0.15 lb. per ton of acid produced (0.075 kg. per metric ton), maximum 2-hour average, expressed as H_2SO_4.

(b) 10 percent opacity or greater.

§ 60.84 Emission monitoring.

(a) There shall be installed, calibrated, maintained, and operated, in any sulfuric acid production unit subject to the provisions of this subpart, an instrument for continuously monitoring and recording emissions of sulfur dioxide.

(b) The instrument and sampling system installed and used pursuant to this section shall be capable of monitoring emission levels within ±20 percent with a confidence level of 95 percent and shall be calibrated in accordance with the method(s) prescribed by the manufacturer(s) of such instrument, the instrument shall be subject to manufacturers recommended zero adjustment calibration procedures at least once per 24-hour operating period unless the manufacturer(s) specified or recommends calibration at shorter intervals, in which case such specifications or recommendations shall be followed. The applicable method specified in the appendix of this part shall be the reference method.

(c) Production rate and hours of operation shall be recorded daily.

(d) The owner or operator of any sulfuric acid production unit subject to the provisions of this subpart shall maintain a file of all measurements required by this subpart. Appropriate measurements shall be reduced to the units of the applicable standard daily and summarized monthly. The record of any such measurement and summary shall be retained for at least 2 years following the date of such measurements and summaries.

§ 60.85 Test methods and procedures.

(a) The provisions of this section are applicable to performance tests for determining emissions of acid mist and sulfur dioxide from sulfuric acid production units.

(b) All performance tests shall be conducted while the affected facility is operating at or above the maximum acid production rate at which such facility will be operated and under such other relevant conditions as the Administrator shall specify based on representative performance of the affected facility.

(c) Test methods set forth in the appendix to this part or equivalent methods as approved by the Administrator shall be used as follows:

(1) For each repetition the acid mist and SO_2 concentrations shall be determined by using Method 8 and traversing according to Method 1. The minimum sampling time shall be 2 hours, and minimum sampling volume shall be 40 ft.^{3} corrected to standard conditions.

(2) The volumetric flow rate of the total effluent shall be determined by using Method 2 and traversing according to Method 1. Gas analysis shall be performed by using the integrated sample technique of Method 3. Moisture content can be considered to be zero.

(d) Acid produced, expressed in tons per hour of 100 percent sulfuric acid shall be determined during each 2-hour testing period by suitable flow meters and shall be confirmed by a material balance over the production system.

(e) For each repetition acid mist and sulfur dioxide emissions, expressed in lb./ton of 100 percent sulfuric acid shall be determined by dividing the emission rate in lb./hr. by the acid produced. The emission rate shall be determined by the equation, lb./hr.$=Q_s\times c$, where Q_s=volumetric flow rate of the effluent in ft.^{3}/hr. at standard conditions, dry basis as determined in accordance with paragraph (c)(2) of this section, and c=acid mist and SO_2 concentrations in lb./ft.^{3} as determined in accordance with paragraph (c)(1) of this section, corrected to standard conditions, dry basis.

APPENDIX—TEST METHODS

METHOD 1—SAMPLE AND VELOCITY TRAVERSES FOR STATIONARY SOURCES

1. *Principle and Applicability.*

1.1 Principle. A sampling site and the number of traverse points are selected to aid in the extraction of a representative sample.

1.2 Applicability. This method should be applied only when specified by the test procedures for determining compliance with the New Source Performance Standards. Unless otherwise specified, this method is not intended to apply to gas streams other than those emitted directly to the atmosphere without further processing.

2. *Procedure.*

2.1 Selection of a sampling site and minimum number of traverse points.

2.1.1 Select a sampling site that is at least eight stack or duct diameters downstream and two diameters upstream from any flow disturbance such as a bend, expansion, contraction, or visible flame. For rectangular cross section, determine an equivalent diameter from the following equation:

$$\text{equivalent diameter}=2\left(\frac{(\text{length})(\text{width})}{\text{length}+\text{width}}\right)$$

equation 1-1

2.1.2 When the above sampling site criteria can be met, the minimum number of traverse points is twelve (12).

2.1.3 Some sampling situations render the above sampling site criteria impractical. When this is the case, choose a convenient sampling location and use Figure 1-1 to determine the minimum number of traverse points. Under no conditions should a sampling point be selected within 1 inch of the stack wall. To obtain the number of traverse points for stacks or ducts with a diameter less than 2 feet, multiply the number of points obtained from Figure 1-1 by 0.67.

2.1.4 To use Figure 1-1 first measure the distance from the chosen sampling location to the nearest upstream and downstream disturbances. Determine the corresponding number of traverse points for each distance from Figure 1-1. Select the higher of the two numbers of traverse points, or a greater value, such that for circular stacks the number is a multiple of 4, and for rectangular stacks the number follows the criteria of section 2.2.2.

2.2 Cross-sectional layout and location of traverse points.

2.2.1 For circular stacks locate the traverse points on at least two diameters according to Figure 1-2 and Table 1-1. The traverse axes shall divide the stack cross section into equal parts.

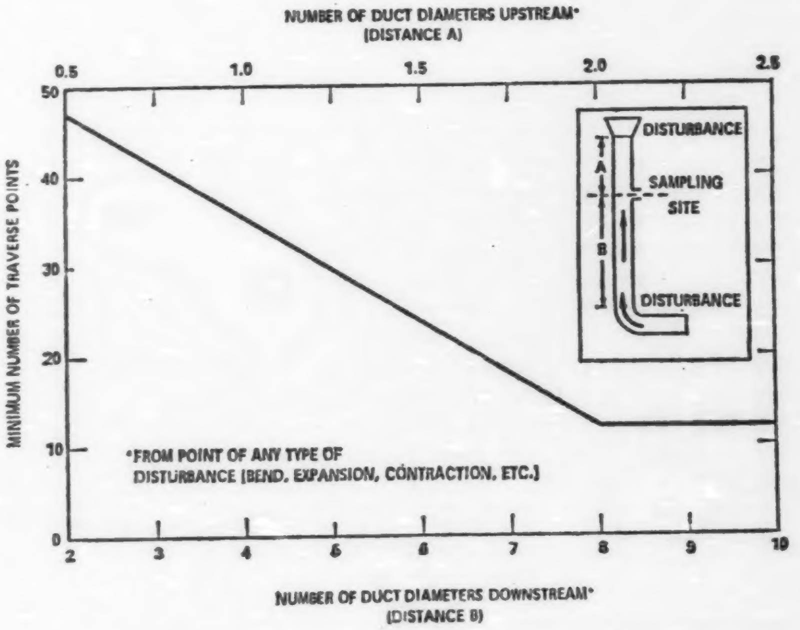

Figure 1-1. Minimum number of traverse points.

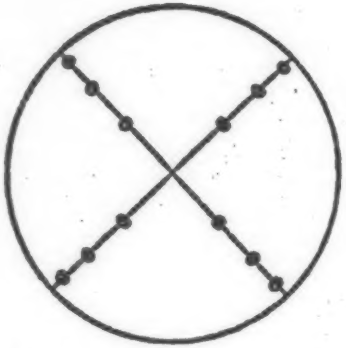

Figure 1-2. Cross section of circular stack divided into 12 equal areas, showing location of traverse points at centroid of each area.

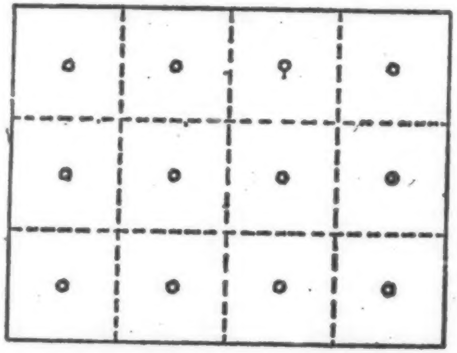

Figure 1-3. Cross section of rectangular stack divided into 12 equal areas, with traverse points at centroid of each area.

Table 1-1. Location of traverse points in circular stacks
(Percent of stack diameter from inside wall to traverse point)

Traverse point number on a diameter	Number of traverse points on a diameter											
	2	4	6	8	10	12	14	16	18	20	22	24
1	14.6	6.7	4.4	3.3	2.5	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	85.4	25.0	14.7	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3		75.0	29.5	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4		93.3	70.5	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5			85.3	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6			95.6	80.6	65.8	35.5	26.9	22.0	18.8	16.5	14.6	13.2
7				89.5	77.4	64.5	36.6	28.3	23.6	20.4	18.0	16.1
8				96.7	85.4	65.0	63.4	37.5	29.6	25.0	21.8	19.4
9					91.8	82.3	73.1	62.5	38.2	30.6	26.1	23.0
10					97.5	88.2	79.9	71.7	61.8	38.8	31.5	27.2
11						93.3	85.4	78.0	70.4	61.2	39.3	32.3
12						97.9	90.1	83.1	76.4	69.4	60.7	39.8
13							94.3	87.5	81.2	75.0	68.5	60.2
14							98.2	91.5	85.4	79.6	73.9	67.7
15								95.1	89.1	83.5	78.2	72.8
16								98.4	92.5	87.1	82.0	77.0
17									95.6	90.3	85.4	80.6
18									98.6	93.3	88.4	83.9
19										96.1	91.3	86.8
20										98.7	94.0	89.5
21											96.5	92.1
22											98.9	94.5
23												96.8
24												98.9

2.2.2 For rectangular stacks divide the cross section into as many equal rectangular areas as traverse points, such that the ratio of the length to the width of the elemental areas is between one and two. Locate the traverse points at the centroid of each equal area according to Figure 1-3.

3. *References.*

Determining Dust Concentration in a Gas Stream, ASME Performance Test Code #27, New York, N.Y., 1957.

Devorkin, Howard, et al., Air Pollution Source Testing Manual, Air Pollution Control District, Los Angeles, Calif. November 1963.

Methods for Determination of Velocity, Volume, Dust and Mist Content of Gases, Western Precipitation Division of Joy Manufacturing Co., Los Angeles, Calif. Bulletin WP-50, 1968.

Standard Method for Sampling Stacks for Particulate Matter, In: 1971 Book of ASTM Standards, Part 23, Philadelphia, Pa. 1971, ASTM Designation D-2928-71.

METHOD 2—DETERMINATION OF STACK GAS VELOCITY AND VOLUMETRIC FLOW RATE (TYPE S PITOT TUBE)

1. *Principle and applicability.*

1.1 Principle. Stack gas velocity is determined from the gas density and from measurement of the velocity head using a Type S (Stauscheibe or reverse type) pitot tube.

1.2 Applicability. This method should be applied only when specified by the test procedures for determining compliance with the New Source Performance Standards.

2. *Apparatus.*

2.1 Pitot tube—Type S (Figure 2-1), or equivalent, with a coefficient within ±5% over the working range.

2.2 Differential pressure gauge—Inclined manometer, or equivalent, to measure velocity head to within 10% of the minimum value.

2.3 Temperature gauge—Thermocouple or equivalent attached to the pitot tube to measure stack temperature to within 1.5% of the minimum absolute stack temperature.

2.4 Pressure gauge—Mercury-filled U-tube manometer, or equivalent, to measure stack pressure to within 0.1 in. Hg.

2.5 Barometer—To measure atmospheric pressure to within 0.1 in. Hg.

2.6 Gas analyzer—To analyze gas composition for determining molecular weight.

2.7 Pitot tube—Standard type, to calibrate Type S pitot tube.

3. *Procedure.*

3.1 Set up the apparatus as shown in Figure 2-1. Make sure all connections are tight and leak free. Measure the velocity head and temperature at the traverse points specified by Method 1.

3.2 Measure the static pressure in the stack.

3.3 Determine the stack gas molecular weight by gas analysis and appropriate calculations as indicated in Method 3.

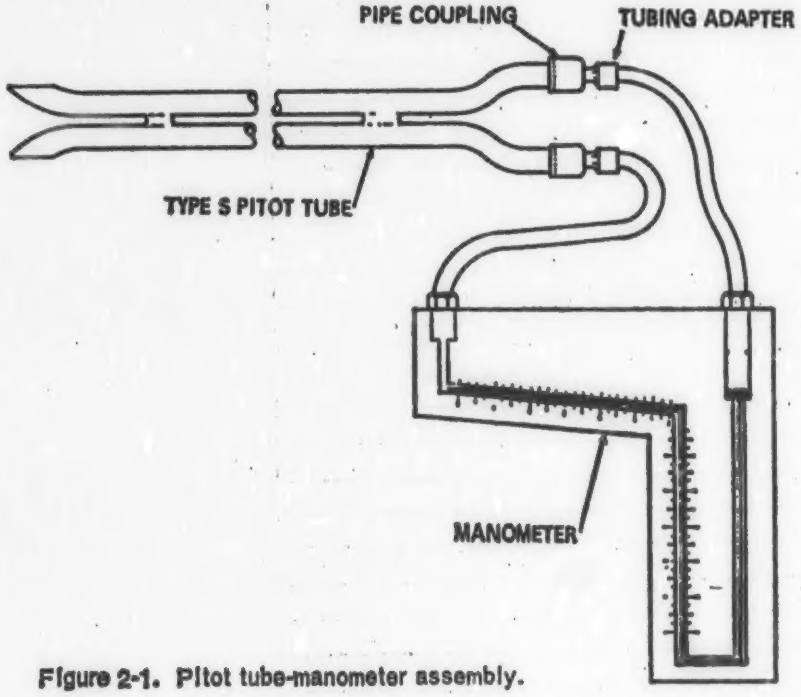

Figure 2-1. Pitot tube-manometer assembly.

4. *Calibration.*

4.1 To calibrate the pitot tube, measure the velocity head at some point in a flowing gas stream with both a Type S pitot tube and a standard type pitot tube with known coefficient. Calibration should be done in the laboratory and the velocity of the flowing gas stream should be varied over the normal working range. It is recommended that the calibration be repeated after use at each field site.

4.2 Calculate the pitot tube coefficient using equation 2-1.

$$C_{p_{test}}=C_{p_{std}}\sqrt{\frac{\Delta p_{std}}{\Delta p_{test}}} \quad \text{equation 2-1}$$

where:

$C_{p_{test}}$ = Pitot tube coefficient of Type S pitot tube.

$C_{p_{std}}$ = Pitot tube coefficient of standard type pitot tube (if unknown, use 0.99).

Δp_{std} = Velocity head measured by standard type pitot tube.

Δp_{test} = Velocity head measured by Type S pitot tube.

4.3 Compare the coefficients of the Type S pitot tube determined first with one leg and then the other pointed downstream. Use the pitot tube only if the two coefficients differ by no more than 0.01.

5. *Calculations.*

Use equation 2-2 to calculate the stack gas velocity.

$$(V_s)_{avg.}=K_pC_p(\sqrt{\Delta p})_{avg.}\sqrt{\frac{(T_s)_{avg.}}{P_sM_s}}$$

Equation 2-2

where:

$(V_s)_{avg.}$ = Stack gas velocity, feet per second (f.p.s.).

$K_p=85.48\frac{\text{ft.}}{\text{sec.}}\left(\frac{\text{lb.}}{\text{lb. mole-°R}}\right)^{1/2}$ when these units are used.

C_p = Pitot tube coefficient, dimensionless.

$(T_s)_{avg.}$ = Average absolute stack gas temperature, °R.

$(\sqrt{\Delta p})_{avg.}$ = Average velocity head of stack gas, inches H_2O (see Fig. 2-2).

P_s = Absolute stack gas pressure, inches Hg.

M_s = Molecular weight of stack gas (wet basis), lb./lb.-mole.

$M_d(1-B_{wo})+18B_{wo}$

M_d = Dry molecular weight of stack gas (from Method 3).

B_{wo} = Proportion by volume of water vapor in the gas stream (from Method 4).

Figure 2-2 shows a sample recording sheet for velocity traverse data. Use the averages in the last two columns of Figure 2-2 to determine the average stack gas velocity from Equation 2-2.

Use Equation 2-3 to calculate the stack gas volumetric flow rate.

$$Q_s=3600\ (1-B_{wo})V_sA\left(\frac{T_{std}}{(T_s)_{avg.}}\right)\left(\frac{P_s}{P_{std}}\right)$$

Equation 2-3

where:

Q_s = Volumetric flow rate, dry basis, standard conditions, ft.^{3}/hr.

A = Cross-sectional area of stack, ft.^{2}

T_{std} = Absolute temperature at standard conditions, 530° R.

P_{std} = Absolute pressure at standard conditions, 29.92 inches Hg.

6. *References.*

Mark, L. S., Mechanical Engineers' Handbook, McGraw-Hill Book Co., Inc., New York, N.Y., 1951.

Perry, J. H., Chemical Engineers' Handbook, McGraw-Hill Book Co., Inc., New York, N.Y., 1960.

Shigehara, R. T., W. F. Todd, and W. S. Smith, Significance of Errors in Stack Sampling Measurements. Paper presented at the Annual Meeting of the Air Pollution Control Association, St. Louis, Mo., June 14–18, 1970.

Standard Method for Sampling Stacks for Particulate Matter, In: 1971 Book of ASTM Standards, Part 23, Philadelphia, Pa., 1971, ASTM Designation D-2928-71.

Vennard, J. K., Elementary Fluid Mechanics, John Wiley & Sons, Inc., New York, N.Y., 1947.

PLANT______________________________

DATE______________________________

RUN NO.____________________________

STACK DIAMETER, in.__________________

BAROMETRIC PRESSURE, in. Hg.____________

STATIC PRESSURE IN STACK (P_g), in. Hg.______

OPERATORS__________________________

SCHEMATIC OF STACK CROSS SECTION

Traverse point number	Velocity head, in. H_2O	$\sqrt{\Delta_p}$	Stack Temperature (T_S), °F
	AVERAGE:		

Figure 2-2. Velocity traverse data.

METHOD 3—GAS ANALYSIS FOR CARBON DIOXIDE, EXCESS AIR, AND DRY MOLECULAR WEIGHT

1. *Principle and applicability.*

1.1 Principle. An integrated or grab gas sample is extracted from a sampling point and analyzed for its components using an Orsat analyzer.

1.2 Applicability. This method should be applied only when specified by the test procedures for determining compliance with the ew Source Performance Standards. The test ocedure will indicate whether a grab sam-le or an integrated sample is to be used.

2. *Apparatus.*

2.1 Grab sample (Figure 3-1).

2.1.1 Probe—Stainless steel or Pyrex[1] glass, equipped with a filter to remove particulate matter.

2.1.2 Pump—One-way squeeze bulb, or equivalent, to transport gas sample to analyzer.

2.2 *Integrated sample (Figure 3-2).*

2.2.1 Probe—Stainless steel or Pyrex[1] glass, equipped with a filter to remove particulate matter.

2.2.2 Air-cooled condenser or equivalent—To remove any excess moisture.

2.2.3 Needle valve—To adjust flow rate.

2.2.4 Pump—Leak-free, diaphragm type, or equivalent, to pull gas.

2.2.5 Rate meter—To measure a flow range from 0 to 0.035 cfm.

2.2.6 Flexible bag—Tedlar,[1] or equivalent, with a capacity of 2 to 3 cu. ft. Leak test the bag in the laboratory before using.

2.2.7 Pitot tube—Type S, or equivalent, attached to the probe so that the sampling flow rate can be regulated proportional to the stack gas velocity when velocity is varying with time or a sample traverse is conducted.

2.3 *Analysis.*

2.3.1 Orsat analyzer, or equivalent.

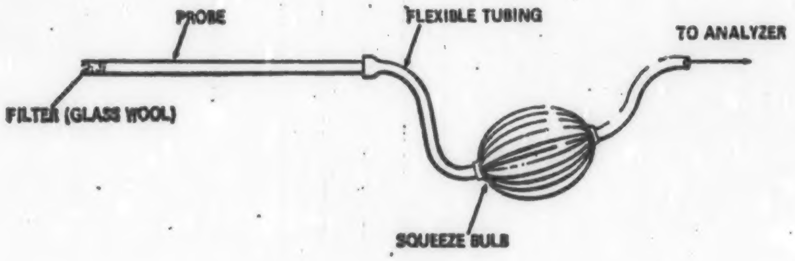

Figure 3-1. Grab-sampling train.

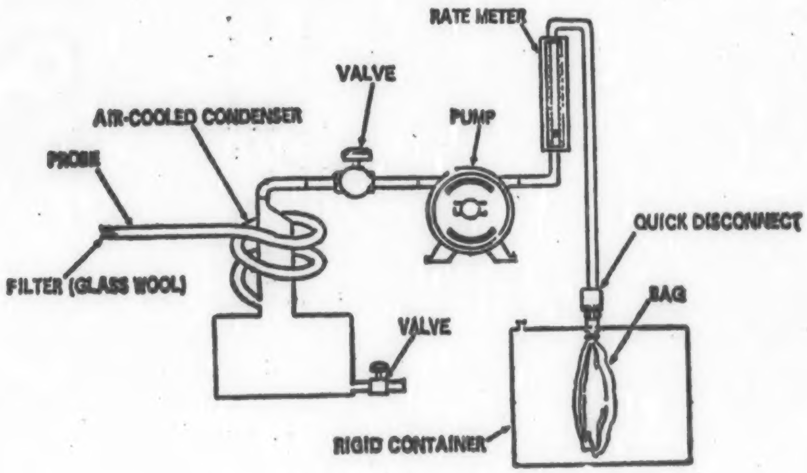

Figure 3-2. Integrated gas - sampling train.

3. *Procedure.*

3.1 Grab sampling.

3.1.1 Set up the equipment as shown in Figure 3-1, making sure all connections are leak-free. Place the probe in the stack at a sampling point and purge the sampling line.

3.1.2 Draw sample into the analyzer

3.2 Integrated sampling.

3.2.1 Evacuate the flexible bag. Set up the equipment as shown in Figure 3-2 with the bag disconnected. Place the probe in the stack and purge the sampling line. Connect the bag, making sure that all connections are tight and that there are no leaks.

3.2.2 Sample at a rate proportional to the stack velocity.

3.3 Analysis.

3.3.1 Determine the CO_2, O_2, and CO concentrations as soon as possible. Make as many passes as are necessary to give constant readings. If more than ten passes are necessary, replace the absorbing solution.

3.3.2 For grab sampling, repeat the sampling and analysis until three consecutive samples vary no more than 0.5 percent by volume for each component being analyzed.

3.3.3 For integrated sampling, repeat the analysis of the sample until three consecutive analyses vary no more than 0.2 percent by volume for each component being analyzed.

4. *Calculations.*

4.1 Carbon dioxide. Average the three consecutive runs and report the result to the nearest 0.1% CO_2.

4.2 Excess air. Use Equation 3-1 to calculate excess air, and average the runs. Report the result to the nearest 0.1% excess air.

$$\%\,EA=\frac{(\%\,O_2)-0.3(\%\,CO)}{0.264(\%\,N_2)-(\%\,O_2)+0.5(\%\,CO)}\times 100$$

equation 3-1

where:

$\%EA$ = Percent excess air.
$\%O_2$ = Percent oxygen by volume, dry basis.
$\%N_2$ = Percent nitrogen by volume, dry basis.
$\%CO$ = Percent carbon monoxide by volume, dry basis.
0.264 = Ratio of oxygen to nitrogen in air by volume.

4.3 Dry molecular weight. Use Equation 3-2 to calculate dry molecular weight and average the runs. Report the result to the nearest tenth.

$$M_d=0.44(\%CO_2)+0.32(\%O_2)+0.28(\%N_2+\%CO)$$

equation 3-2

where:

M_d = Dry molecular weight, lb./lb-mole.
$\%CO_2$ = Percent carbon dioxide by volume, dry basis.
$\%O_2$ = Percent oxygen by volume, dry basis.
$\%N_2$ = Percent nitrogen by volume, dry basis.
0.44 = Molecular weight of carbon dioxide divided by 100.
0.32 = Molecular weight of oxygen divided by 100.
0.28 = Molecular weight of nitrogen and CO divided by 100.

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[1] Trade name.

5. References.

Altshuller, A. P., et al., Storage of Gases and Vapors in Plastic Bags, Int. J. Air & Water Pollution, 6:75–81, 1963.

Conner, William D., and J. S. Nader, Air Sampling with Plastic Bags, Journal of the American Industrial Hygiene Association, 25:291–297, May–June 1964.

Devorkin, Howard, et al., Air Pollution Source Testing Manual, Air Pollution Control District, Los Angeles, Calif., November 1963.

METHOD 4—DETERMINATION OF MOISTURE IN STACK GASES

1. *Principle and applicability.*

1.1 Principle. Moisture is removed from the gas stream, condensed, and determined volumetrically.

1.2 Applicability. This method is applicable for the determination of moisture in stack gas only when specified by test procedures for determining compliance with New Source Performance Standards. This method does not apply when liquid droplets are present in the gas stream[1] and the moisture is subsequently used in the determination of stack gas molecular weight.

Other methods such as drying tubes, wet bulb-dry bulb techniques, and volumetric condensation techniques may be used.

2. *Apparatus.*

2.1 Probe—Stainless steel or Pyrex[2] glass sufficiently heated to prevent condensation and equipped with a filter to remove particulate matter.

2.2 Impingers—Two midget impingers, each with 30 ml. capacity, or equivalent.

2.3 Ice bath container—To condense moisture in impingers.

2.4 Silica gel tube (optional)—To protect pump and dry gas meter.

2.5 Needle valve—To regulate gas flow rate.

2.6 Pump—Leak-free, diaphragm type, or equivalent, to pull gas through train.

2.7 Dry gas meter—To measure to within 1% of the total sample volume.

2.8 Rotameter—To measure a flow range from 0 to 0.1 c.f.m.

2.9 Graduated cylinder—25 ml.

2.10 Barometer—Sufficient to read to within 0.1 inch Hg.

2.11 Pitot tube—Type S, or equivalent, attached to probe so that the sampling flow rate can be regulated proportional to the stack gas velocity when velocity is varying with time or a sample traverse is conducted.

3. *Procedure.*

3.1 Place exactly 5 ml. distilled water in each impinger. Assemble the apparatus without the probe as shown in Figure 4-1. Leak check by plugging the inlet to the first impinger and drawing a vacuum. Insure that flow through the dry gas meter is less than 1% of the sampling rate.

3.2 Connect the probe and sample at a constant rate of 0.075 c.f.m. or at a rate proportional to the stack gas velocity. Continue sampling until the dry gas meter registers 1 cubic foot or until visible liquid droplets are carried over from the first impinger to the second. Record temperature, pressure, and dry gas meter readings as required by Figure 4-2.

3.3 After collecting the sample, measure the volume increase to the nearest 0.5 ml.

4. *Calculations.*

4.1 Volume of water vapor collected.

$$V_{wc}=\frac{(V_f-V_i)\rho_{H_2O}RT_{std}}{P_{std}M_{H_2O}}=0.0474\frac{\text{ft.}^3}{\text{ml.}}(V_f-V_i) \qquad \text{equation 4-1}$$

where:

V_{wc}=Volume of water vapor collected (standard conditions), cu. ft.

V_f=Final volume of impinger contents, ml.

V_i=Initial volume of impinger contents, ml.

R=Ideal gas constant, 21.83 inches Hg—cu. ft./lb. mole-°R.

ρ_{H_2O}=Density of water, 1 g./ml.

T_{std}=Absolute temperature at standard conditions, 530° R.

P_{std}=Absolute pressure at standard conditions, 29.92 inches Hg.

M_{H_2O}=Molecular weight of water, 18 lb./lb.-mole.

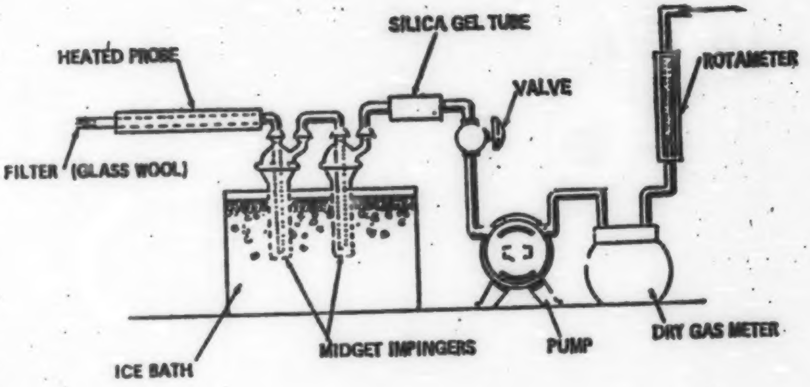

Figure 4-1. Moisture-sampling train.

LOCATION______________ COMMENTS

TEST______________

DATE______________

OPERATOR______________

BAROMETRIC PRESSURE______________

CLOCK TIME	GAS VOLUME THROUGH METER, (Vm), ft^3	ROTAMETER SETTING ft^3/min	METER TEMPERATURE, °F

Figure 4-2. Field moisture determination.

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[1] If liquid droplets are present in the gas stream, assume the stream to be saturated, determine the average stack gas temperature by traversing according to Method 1, and use a psychrometric chart to obtain an approximation of the moisture percentage.

[2] Trade name.

4.2 Gas volume.

$$V_{mc}=V_m\left(\frac{P_m}{P_{std}}\right)\left(\frac{T_{std}}{T_m}\right)=17.71\ \frac{°R}{\text{in. Hg}}\left(\frac{V_mP_m}{T_m}\right)\quad \text{equation 4–2}$$

where:

V_{mc} = Dry gas volume through meter at standard conditions, cu. ft.
V_m = Dry gas volume measured by meter, cu. ft.
P_m = Barometric pressure at the dry gas meter, inches Hg.
P_{std} = Pressure at standard conditions, 29.92 inches Hg.
T_{std} = Absolute temperature at standard conditions, 530° R.
T_m = Absolute temperature at meter (°F + 460), °R.

4.3 Moisture content.

$$B_{wo}=\frac{V_{wc}}{V_{wc}+V_{mc}}+B_{wm}=\frac{V_{wc}}{V_{wc}+V_{mc}}+(0.025)\quad \text{equation 4–3}$$

where:

B_{wo} = Proportion by volume of water vapor in the gas stream, dimensionless.
V_{wc} = Volume of water vapor collected (standard conditions), cu. ft.
V_{mc} = Dry gas volume through meter (standard conditions), cu. ft.
B_{wm} = Approximate volumetric proportion of water vapor in the gas stream leaving the impingers, 0.025.

5. *References.*

Air Pollution Engineering Manual, Danielson, J. A. (ed.), U.S. DHEW, PHS, National Center for Air Pollution Control, Cincinnati, Ohio, PHS Publication No. 999–AP–40, 1967.

Devorkin, Howard, et al., Air Pollution Source Testing Manual, Air Pollution Control District, Los Angeles, Calif., November 1963.

Methods for Determination of Velocity, Volume, Dust and Mist Content of Gases, Western Precipitation Division of Joy Manufacturing Co., Los Angeles, Calif., Bulletin WP–50, 1968.

METHOD 5—DETERMINATION OF PARTICULATE EMISSIONS FROM STATIONARY SOURCES

1. *Principle and applicability.*

1.1 Principle. Particulate matter is withdrawn isokinetically from the source and its weight is determined gravimetrically after removal of uncombined water.

1.2 Applicability. This method is applicable for the determination of particulate emissions from stationary sources only when specified by the test procedures for determining compliance with New Source Performance Standards.

2. *Apparatus.*

2.1 Sampling train. The design specifications of the particulate sampling train used by EPA (Figure 5–1) are described in APTD–0581. Commercial models of this train are available.

2.1.1 Nozzle—Stainless steel (316) with sharp, tapered leading edge.

2.1.2 Probe—Pyrex[1] glass with a heating system capable of maintaining a minimum gas temperature of 250° F. at the exit end during sampling to prevent condensation from occurring. When length limitations (greater than about 8 ft.) are encountered at temperatures less than 600° F., Incoloy 825[1], or equivalent, may be used. Probes for sampling gas streams at temperatures in excess of 600° F. must have been approved by the Administrator.

2.1.3 Pitot tube—Type S, or equivalent, attached to probe to monitor stack gas velocity.

2.1.4 Filter Holder—Pyrex[1] glass with heating system capable of maintaining minimum temperature of 225° F.

2.1.5 Impingers / Condenser—Four impingers connected in series with glass ball joint fittings. The first, third, and fourth impingers are of the Greenburg-Smith design, modified by replacing the tip with a ½-inch ID glass tube extending to one-half inch from the bottom of the flask. The second impinger is of the Greenburg-Smith design with the standard tip. A condenser may be used in place of the impingers provided that the moisture content of the stack gas can still be determined.

2.1.6 Metering system—Vacuum gauge, leak-free pump, thermometers capable of measuring temperature to within 5° F., dry gas meter with 2% accuracy, and related equipment, or equivalent, as required to maintain an isokinetic sampling rate and to determine sample volume.

2.1.7 Barometer—To measure atmospheric pressure to ±0.1 inches Hg.

2.2 Sample recovery.

2.2.1 Probe brush—At least as long as probe.

2.2.2 Glass wash bottles—Two.

2.2.3 Glass sample storage containers.

2.2.4 Graduated cylinder—250 ml.

2.3 Analysis.

2.3.1 Glass weighing dishes.

2.3.2 Desiccator.

2.3.3 Analytical balance—To measure to ±0.1 mg.

2.3.4 Trip balance—300 g. capacity to measure to ±0.05 g.

3. *Reagents.*

3.1 Sampling.

3.1.1 Filters—Glass fiber, MSA 1106 BH[1], or equivalent, numbered for identification and preweighed.

3.1.2 Silica gel—Indicating type, 6–16 mesh, dried at 175° C. (350° F.) for 2 hours.

3.1.3 Water.

3.1.4 Crushed ice.

3.2 Sample recovery.

3.2.1 Acetone—Reagent grade.

3.3 Analysis.

3.3.1 Water.

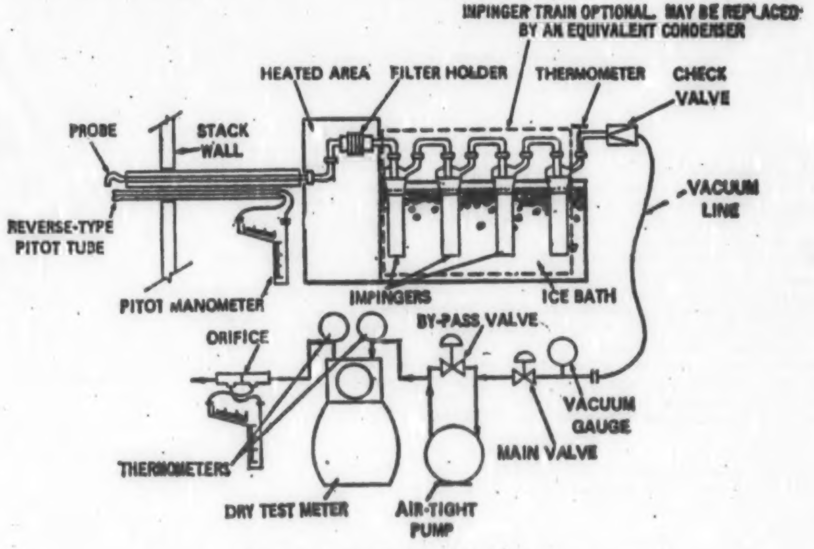

Figure 5-1. Particulate-sampling train.

3.3.2 Desiccant—Drierite,[1] indicating.

4. *Procedure.*

4.1 Sampling

4.1.1 After selecting the sampling site and the minimum number of sampling points, determine the stack pressure, temperature, moisture, and range of velocity head.

4.1.2 Preparation of collection train. Weigh to the nearest gram approximately 200 g. of silica gel. Label a filter of proper diameter, desiccate[2] for at least 24 hours and weigh to the nearest 0.5 mg. in a room where the relative humidity is less than 50%. Place 100 ml. of water in each of the first two impingers, leave the third impinger empty, and place approximately 200 g. of preweighed silica gel in the fourth impinger. Set up the train without the probe as in Figure 5–1. Leak check the sampling train at the sampling site by plugging up the inlet to the filter holder and pulling a 15 in. Hg vacuum. A leakage rate not in excess of 0.02 c.f.m. at a vacuum of 15 in. Hg is acceptable. Attach the probe and adjust the heater to provide a gas temperature of about 250° F. at the probe outlet. Turn on the filter heating system. Place crushed ice around the impingers. Add more ice during the run to keep the temperature of the gases leaving the last impinger as low as possible and preferably at 70° F. or less. Temperatures above 70° F. may result in damage to the dry gas meter from either moisture condensation or excessive heat.

4.1.3 Particulate train operation. For each run, record the data required on the example sheet shown in Figure 5–2. Take readings at each sampling point, at least every 5 minutes, and when significant changes in stack conditions necessitate additional adjustments in flow rate. To begin sampling, position the nozzle at the first traverse point with the tip pointing directly into the gas stream. Immediately start the pump and adjust the flow to isokinetic conditions. Sample for at least 5 minutes at each traverse point; sampling time must be the same for each point. Maintain isokinetic sampling throughout the sampling period. Nomographs are available which aid in the rapid adjustment of the sampling rate without other computations. APTD–0576 details the procedure for using these nomographs. Turn off the pump at the conclusion of each run and record the final readings. Remove the probe and nozzle from the stack and handle in accordance with the sample recovery process described in section 4.2.

---

[1] Trade name.

[1] Trade name.

[2] Dry using Drierite[1] at 70° F. ± 10° F.

PLANT__________
LOCATION__________
OPERATOR__________
DATE__________
RUN NO.__________
SAMPLE BOX NO.__________
METER BOX NO.__________
METER $\Delta H_@$__________
C FACTOR__________

SCHEMATIC OF STACK CROSS SECTION

AMBIENT TEMPERATURE__________
BAROMETRIC PRESSURE__________
ASSUMED MOISTURE, %__________
HEATER BOX SETTING__________
PROBE LENGTH, in.__________
NOZZLE DIAMETER, in.__________
PROBE HEATER SETTING__________

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min.	STATIC PRESSURE (P_s), in. Hg.	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH), in. H_2O	GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER		SAMPLE BOX TEMPERATURE, °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER, °F
							INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F		
TOTAL							Avg.	Avg.		
AVERAGE							Avg.			

Figure 5-2. Particulate field data.

4.2 Sample recovery. Exercise care in moving the collection train from the test site to the sample recovery area to minimize the loss of collected sample or the gain of extraneous particulate matter. Set aside a portion of the acetone used in the sample recovery as a blank for analysis. Measure the volume of water from the first three impingers, then discard. Place the samples in containers as follows:

Container No. 1. Remove the filter from its holder, place in this container, and seal.

Container No. 2. Place loose particulate matter and acetone washings from all sample-exposed surfaces prior to the filter in this container and seal. Use a razor blade, brush, or rubber policeman to lose adhering particles.

Container No. 3. Transfer the silica gel from the fourth impinger to the original container and seal. Use a rubber policeman as an aid in removing silica gel from the impinger.

4.3 Analysis. Record the data required on the example sheet shown in Figure 5-3. Handle each sample container as follows:

Container No. 1. Transfer the filter and any loose particulate matter from the sample container to a tared glass weighing dish, desiccate, and dry to a constant weight. Report results to the nearest 0.5 mg.

Container No. 2. Transfer the acetone washings to a tared beaker and evaporate to dryness at ambient temperature and pressure. Desiccate and dry to a constant weight. Report results to the nearest 0.5 mg.

Container No. 3. Weigh the spent silica gel and report to the nearest gram.

5. *Calibration.*

Use methods and equipment which have been approved by the Administrator to calibrate the orifice meter, pitot tube, dry gas meter, and probe heater. Recalibrate after each test series.

6. *Calculations.*

6.1 Average dry gas meter temperature and average orifice pressure drop. See data sheet (Figure 5-2).

6.2 Dry gas volume. Correct the sample volume measured by the dry gas meter to standard conditions (70° F., 29.92 inches Hg) by using Equation 5-1.

$$V_{m_{std}}=V_m\left(\frac{T_{std}}{T_m}\right)\left(\frac{P_{bar}+\frac{\Delta H}{13.6}}{P_{std}}\right)=\left(17.71\ \frac{°\mathrm{R}}{\mathrm{in.\ Hg}}\right)V_m\left(\frac{P_{bar}+\frac{\Delta H}{13.6}}{T_m}\right)$$

equation 5-1

where:

$V_{m_{std}}$ = Volume of gas sample through the dry gas meter (standard conditions), cu. ft.

V_m = Volume of gas sample through the dry gas meter (meter conditions), cu. ft.

T_{std} = Absolute temperature at standard conditions, 530° R.

T_m = Average dry gas meter temperature, °R.

P_{bar} = Barometric pressure at the orifice meter, inches Hg.

ΔH = Average pressure drop across the orifice meter, inches H_2O.

13.6 = Specific gravity of mercury.

P_{std} = Absolute pressure at standard conditions, 29.92 inches Hg.

6.3 Volume of water vapor.

$$V_{w_{std}}=V_{l_c}\left(\frac{\rho_{H_2O}}{M_{H_2O}}\right)\left(\frac{RT_{std}}{P_{std}}\right)=\left(0.0474\ \frac{\mathrm{cu.\ ft.}}{\mathrm{ml.}}\right)V_{l_c}$$

equation 5-2

where:

$V_{w_{std}}$ = Volume of water vapor in the gas sample (standard conditions), cu. ft.

V_{l_c} = Total volume of liquid collected in impingers and silica gel (see Figure 5-3), ml.

ρ_{H_2O} = Density of water, 1 g./ml.

M_{H_2O} = Molecular weight of water, 18 lb./lb.-mole.

R = Ideal gas constant, 21.83 inches Hg—cu. ft./lb.-mole-°R.

T_{std} = Absolute temperature at standard conditions, 530° R.

P_{std} = Absolute pressure at standard conditions, 29.92 inches Hg.

6.4 Moisture content.

$$B_{wo}=\frac{V_{w_{std}}}{V_{m_{std}}+V_{w_{std}}}$$

equation 5-3

where:

B_{wo} = Proportion by volume of water vapor in the gas stream, dimensionless.

$V_{w_{std}}$ = Volume of water in the gas sample (standard conditions), cu. ft.

$V_{m_{std}}$ = Volume of gas sample through the dry gas meter (standard conditions), cu. ft.

6.5 Total particulate weight. Determine the total particulate catch from the sum of the weights on the analysis data sheet (Figure 5-3).

6.6 Concentration.

6.6.1 Concentration in gr./s.c.f.

$$c'_s=\left(0.0154\ \frac{\mathrm{gr.}}{\mathrm{mg.}}\right)\left(\frac{M_n}{V_{m_{std}}}\right)$$

equation 5-4

where:

c'_s = Concentration of particulate matter in stack gas, gr./s.c.f., dry basis.

M_n = Total amount of particulate matter collected, mg.

$V_{m_{std}}$ = Volume of gas sample through dry gas meter (standard conditions), cu. ft.

PLANT____________________

DATE ____________________

RUN NO.____________________

CONTAINER NUMBER	WEIGHT OF PARTICULATE COLLECTED, mg		
	FINAL WEIGHT	TARE WEIGHT	WEIGHT GAIN
1			
2			
TOTAL	X	X	

	VOLUME OF LIQUID WATER COLLECTED		
	IMPINGER VOLUME, ml	SILICA GEL WEIGHT, g	
FINAL			
INITIAL			
LIQUID COLLECTED			
TOTAL VOLUME COLLECTED		g*	ml

CONVERT WEIGHT OF WATER TO VOLUME BY DIVIDING TOTAL WEIGHT INCREASE BY DENSITY OF WATER. (1 g ml):

$$\frac{\text{INCREASE, g}}{(1\ \text{g/ml})} = \text{VOLUME WATER, ml}$$

Figure 5-3. Analytical data.

6.6.2 Concentration in lb./cu. ft.

$$c_s=\frac{\left(\frac{1}{453{,}600}\frac{\text{lb.}}{\text{mg.}}\right)M_n}{V_{m_{std}}}=2.205\times10^{-6}\frac{M_n}{V_{m_{std}}} \qquad \text{equation 5-5}$$

where:

c_s = Concentration of particulate matter in stack gas, lb./s.c.f., dry basis.

453,600 = Mg/lb.

M_n = Total amount of particulate matter collected, mg.

$V_{m_{std}}$ = Volume of gas sample through dry gas meter (standard conditions); cu. ft.

6.7 Isokinetic variation.

$$I=\frac{T_s\left[\frac{V_{l_c}(\rho_{H_2O})R}{M_{H_2O}}+\frac{V_m}{T_m}\left(P_{bar}+\frac{\Delta H}{13.6}\right)\right]}{\theta V_s P_s A_n}\times100$$

$$=\frac{\left(1.667\frac{\text{min.}}{\text{sec.}}\right)\left[\left(0.00267\frac{\text{in. Hg-cu. ft.}}{\text{ml.-°R}}\right)V_{l_c}+\frac{V_m}{T_m}\left(P_{bar}+\frac{\Delta H}{13.6}\right)\right]}{\theta V_s P_s A_n} \qquad \text{Equation 5-6}$$

where:

I = Percent of isokinetic sampling.

V_{l_c} = Total volume of liquid collected in impingers and silica gel (See Fig. 5-3), ml.

ρ_{H_2O} = Density of water, 1 g./ml.

R = Ideal gas constant, 21.83 inches Hg-cu. ft./lb. mole-°R.

M_{H_2O} = Molecular weight of water, 18 lb./lb.-mole.

V_m = Volume of gas sample through the dry gas meter (meter conditions), cu. ft.

T_m = Absolute average dry gas meter temperature (see Figure 5-2), °R.

P_{bar} = Barometric pressure at sampling site, inches Hg.

ΔH = Average pressure drop across the orifice (see Fig. 5-2), inches H_2O.

T_s = Absolute average stack gas temperature (see Fig. 5-2), °R.

θ = Total sampling time, min.

V_s = Stack gas velocity calculated by Method 2, Equation 2-2, ft./sec.

P_s = Absolute stack gas pressure, inches Hg.

A_n = Cross-sectional area of nozzle, sq. ft.

6.8 Acceptable results. The following range sets the limit on acceptable isokinetic sampling results:

If $90\% \leq I \leq 110\%$, the results are acceptable, otherwise, reject the results and repeat the test.

7. *Reference.*

Addendum to Specifications for Incinerator Testing at Federal Facilities, PHS, NCAPC, Dec. 6, 1967.

Martin, Robert M., Construction Details of Isokinetic Source Sampling Equipment, Environmental Protection Agency, APTD-0581.

Rom, Jerome J., Maintenance, Calibration, and Operation of Isokinetic Source Sampling Equipment, Environmental Protection Agency, APTD-0576.

Smith, W. S., R. T. Shigehara, and W. F. Todd, A Method of Interpreting Stack Sampling Data, Paper presented at the 63d Annual Meeting of the Air Pollution Control Association, St. Louis, Mo., June 14-19, 1970.

Smith, W. S., et al., Stack Gas Sampling Improved and Simplified with New Equipment, APCA paper No. 67-119, 1967.

Specifications for Incinerator Testing at Federal Facilities, PHS, NCAPC, 1967.

METHOD 6—DETERMINATION OF SULFUR DIOXIDE EMISSIONS FROM STATIONARY SOURCES

1. *Principle and applicability.*

1.1 Principle. A gas sample is extracted from the sampling point in the stack. The acid mist, including sulfur trioxide, is separated from the sulfur dioxide. The sulfur dioxide fraction is measured by the barium-thorin titration method.

1.2 Applicability. This method is applicable for the determination of sulfur dioxide emissions from stationary sources only when specified by the test procedures for determining compliance with New Source Performance Standards.

2. *Apparatus.*

2.1 Sampling. See Figure 6-1.

2.1.1 Probe—Pyrex[1] glass, approximately 5 to 6 mm. ID, with a heating system to prevent condensation and a filtering medium to remove particulate matter including sulfuric acid mist.

2.1.2 Midget bubbler—One, with glass wool packed in top to prevent sulfuric acid mist carryover.

2.1.3 Glass wool.

2.1.4 Midget impingers—Three.

2.1.5 Drying tube—Packed with 6 to 16 mesh indicating-type silica gel, or equivalent, to dry the sample.

2.1.6 Valve—Needle valve, or equivalent, to adjust flow rate.

2.1.7 Pump—Leak-free, vacuum type.

2.1.8 Rate meter—Rotameter or equivalent, to measure a 0-10 s.c.f.h. flow range.

2.1.9 Dry gas meter—Sufficiently accurate to measure the sample volume within 1%.

2.1.10 Pitot tube—Type S, or equivalent, necessary only if a sample traverse is required, or if stack gas velocity varies with time.

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[1] Trade names.

2.2 Sample recovery.

2.2.1 Glass wash bottles—Two.

2.2.2 Polyethylene storage bottles—To store impinger samples.

2.3 Analysis.

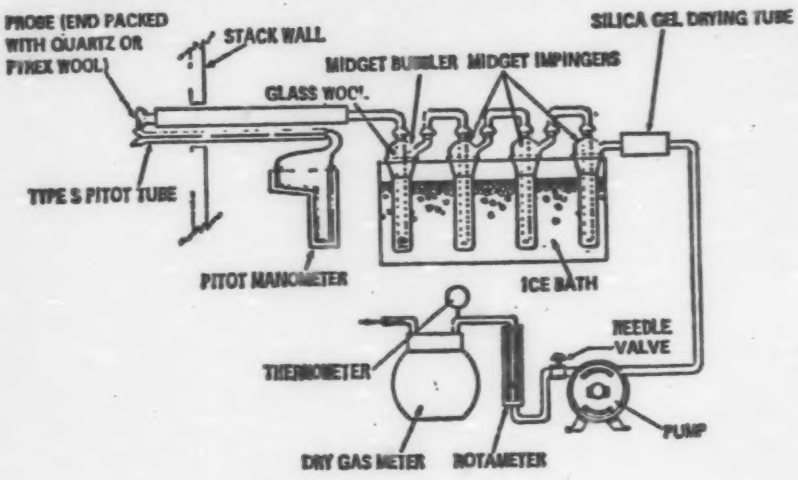

Figure 6-1. SO_2 sampling train.

2.3.1 Pipettes—Transfer type, 5 ml. and 10 ml. sizes (0.1 ml. divisions) and 25 ml. size (0.2 ml. divisions).

2.3.2 Volumetric flasks—50 ml., 100 ml., and 1,000 ml.

2.3.3 Burettes—5 ml. and 50 ml.

2.3.4 Erlenmeyer flask—125 ml.

3. *Reagents.*

3.1 Sampling.

3.1.1 Water—Deionized, distilled.

3.1.2 Isopropanol, 80%—Mix 80 ml. of isopropanol with 20 ml. of distilled water.

3.1.3 Hydrogen peroxide, 3%—dilute 100 ml. of 30% hydrogen peroxide to 1 liter with distilled water. Prepare fresh daily.

3.2 Sample recovery.

3.2.1 Water—Deionized, distilled.

3.2.2 Isopropanol, 80%.

3.3 Analysis.

3.3.1 Water—Deionized, distilled.

3.3.2 Isopropanol.

3.3.3 Thorin indicator—1-(o-arsonophenylazo)-2-naphthol-3,6-disulfonic acid, disodium salt (or equivalent). Dissolve 0.20 g. in 100 ml. distilled water.

3.3.4 Barium perchlorate (0.01 *N*)—Dissolve 1.95 g. of barium perchlorate $[Ba(ClO_4)_2 \cdot 3H_2O]$ in 200 ml. distilled water and dilute to 1 liter with isopropanol. Standardize with sulfuric acid. Barium chloride may be used.

3.3.5 Sulfuric acid standard (0.01 *N*)—Purchase or standardize to ±0.0002 *N* against 0.01N NaOH which has previously been standardized against potassium acid phthalate (primary standard grade).

4. *Procedure.*

4.1 Sampling.

4.1.1 Preparation of collection train. Pour 15 ml. of 80% isopropanol into the midget bubbler and 15 ml. of 3% hydrogen peroxide into each of the first two midget impingers. Leave the final midget impinger dry. Assemble the train as shown in Figure 6-1. Leak check the sampling train at the sampling site by plugging the probe inlet and pulling a 10 inches Hg vacuum. A leakage rate not in excess of 1% of the sampling rate is acceptable. Carefully release the probe inlet plug and turn off the pump. Place crushed ice around the impingers. Add more ice during the run to keep the temperature of the gases leaving the last impinger at 70° F. or less.

4.1.2 Sample collection. Adjust the sample flow rate proportional to the stack gas velocity. Take readings at least every five minutes and when significant changes in stack conditions necessitate additional adjustments in flow rate. To begin sampling, position the tip of the probe at the first sampling point and start the pump. Sample proportionally throughout the run. At the conclusion of each run, turn off the pump and record the final readings. Remove the probe from the stack and disconnect it from the train. Drain the ice bath and purge the remaining part of the train by drawing clean ambient air through the system for 15 minutes.

4.2 Sample recovery. Disconnect the impingers after purging. Discard the contents of the midget bubbler. Pour the contents of the midget impingers into a polyethylene shipment bottle. Rinse the three midget impingers and the connecting tubes with distilled water and add these washings to the same storage container.

4.3 Sample analysis. Transfer the contents of the storage container to a 50 ml. volumetric flask. Dilute to the mark with deionized, distilled water. Pipette a 10 ml. aliquot of this solution into a 125 ml. Erlenmeyer flask. Add 40 ml. of isopropanol and two to four drops of thorin indicator. Titrate to a pink endpoint using 0.01 *N* barium perchlorate. Run a blank with each series of samples.

5. *Calibration.*

5.1 Use standard methods and equipment which have been approved by the Administrator to calibrate the rotameter, pitot tube, dry gas meter, and probe heater.

5.2 Standardize the barium perchlorate against 25 ml. of standard sulfuric acid containing 100 ml. of isopropanol.

6. *Calculations.*

6.1 Dry gas volume. Correct the sample volume measured by the dry gas meter to standard conditions (70° F. and 29.92 inches Hg) by using equation 6-1.

$$V_{m_{std}}=V_m\left(\frac{T_{std}}{T_m}\right)\left(\frac{P_{bar}}{P_{std}}\right)=17.71\,\frac{°R}{\text{in. Hg}}\left(\frac{V_m P_{bar}}{T_m}\right)\qquad\text{equation 6-1}$$

where:

$V_{m_{std}}$=Volume of gas sample through the dry gas meter (standard conditions), cu. ft.

V_m=Volume of gas sample through the dry gas meter (meter conditions), cu. ft.

T_{std}=Absolute temperature at standard conditions, 530° R.

T_m=Average dry gas meter temperature, °R.

P_{bar}=Barometric pressure at the orifice meter, inches Hg.

P_{std}=Absolute pressure at standard conditions, 29.92 inches Hg.

6.2 Sulfur dioxide concentration.

$$C_{SO_2}=\left(7.05\times10^{-5}\,\frac{\text{lb.-l.}}{\text{g.-ml.}}\right)\frac{(V_t-V_{tb})\underline{N}\left(\frac{V_{soln}}{V_a}\right)}{V_{m_{std}}}\qquad\text{equation 6-2}$$

where:

C_{SO_2}=Concentration of sulfur dioxide at standard conditions, dry basis, lb./cu. ft.

7.05×10^{-5}=Conversion factor, including the number of grams per gram equivalent of sulfur dioxide (32 g./g.-eq.), 453.6 g./lb., and 1,000 ml./l., lb.-l./g.-ml.

V_t=Volume of barium perchlorate titrant used for the sample, ml.

V_{tb}=Volume of barium perchlorate titrant used for the blank, ml.

N=Normality of barium perchlorate titrant, g.-eq./l.

V_{soln}=Total solution volume of sulfur dioxide, 50 ml.

V_a=Volume of sample aliquot titrated, ml.

$V_{m_{std}}$=Volume of gas sample through the dry gas meter (standard conditions), cu. ft., see Equation 6-1.

7. *References.*

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Corbett, P. F., The Determination of SO_2 and SO_3 in Flue Gases, Journal of the Institute of Fuel, 24:237-243, 1961.

Matty, R. E. and E. K. Diehl, Measuring Flue-Gas SO_2 and SO_3, Power *101*:94-97, November, 1957.

Patton, W. F. and J. A. Brink, Jr., New Equipment and Techniques for Sampling Chemical Process Gases, J. Air Pollution Control Association, *13*, 162 (1963).

METHOD 7—DETERMINATION OF NITROGEN OXIDE EMISSIONS FROM STATIONARY SOURCES

1. *Principle and applicability.*

1.1 Principle. A grab sample is collected in an evacuated flask containing a dilute sulfuric acid-hydrogen peroxide absorbing solution, and the nitrogen oxides, except nitrous oxide, are measure colorimetrically using the phenoldisulfonic acid (PDS) procedure.

1.2 Applicability. This method is applicable for the measurement of nitrogen oxides from stationary sources only when specified by the test procedures for determining compliance with New Source Performance Standards.

2. *Apparatus.*

2.1 Sampling. See Figure 7-1.

2.1.1 Probe—Pyrex[1] glass, heated, with filter to remove particulate matter. Heating is unnecessary if the probe remains dry during the purging period.

2.1.2 Collection flask—Two-liter, Pyrex,[1] round bottom with short neck and 24/40 standard taper opening, protected against implosion or breakage.

2.1.3 Flask valve—T-bore stopcock connected to a 24/40 standard taper joint.

2.1.4 Temperature gauge—Dial-type thermometer, or equivalent, capable of measuring 2° F. intervals from 25° to 125° F.

2.1.5 Vacuum line—Tubing capable of withstanding a vacuum of 3 inches Hg absolute pressure, with "T" connection and T-bore stopcock, or equivalent.

2.1.6 Pressure gauge—U-tube manometer, 36 inches, with 0.1-inch divisions, or equivalent.

2.1.7 Pump—Capable of producing a vacuum of 3 inches Hg absolute pressure.

2.1.8 Squeeze bulb—One way.

2.2 Sample recovery.

2.2.1 Pipette or dropper.

2.2.2 Glass storage containers—Cushioned for shipping.

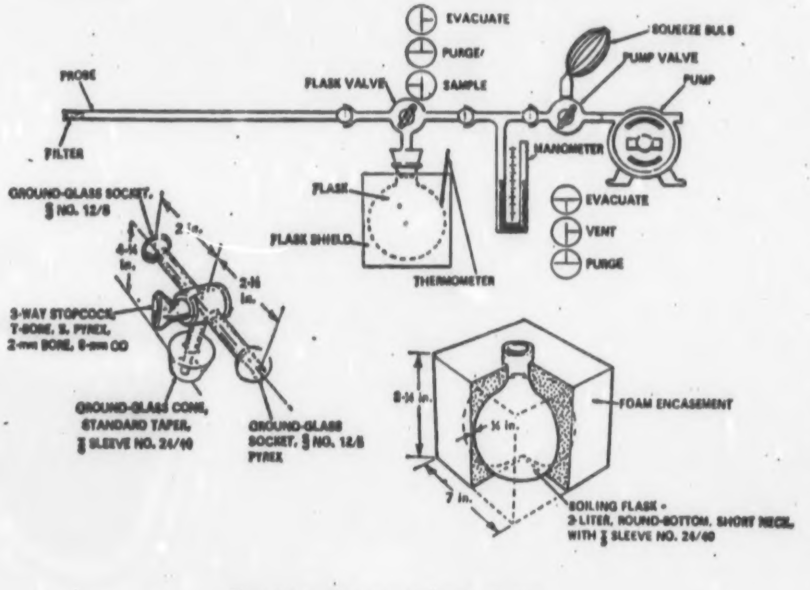
EVACUATE
PURGE/
SAMPLE
SQUEEZE BULB
PUMP VALVE
PUMP
PROBE
FLASK VALVE
FILTER
MANOMETER
FLASK
FLASK SHIELD
THERMOMETER
EVACUATE
VENT
PURGE
GROUND-GLASS SOCKET, § NO. 12/5
2 in.
4-½ in.
2-½ in.
3-WAY STOPCOCK, T-BORE, §, PYREX, 2-mm BORE, 8-mm OD
GROUND-GLASS CONE, STANDARD TAPER, § SLEEVE NO. 24/40
GROUND-GLASS SOCKET, § NO. 12/5 PYREX
8-½ in.
½ in.
7 in.
FOAM ENCASEMENT
BOILING FLASK - 3-LITER, ROUND-BOTTOM, SHORT NECK, WITH § SLEEVE NO. 24/40

Figure 7-1. Sampling train, flask valve, and flask.

2.2.3 Glass wash bottle.

2.3 Analysis.

2.3.1 Steam bath.

2.3.2 Beakers or casseroles—250 ml., one for each sample and standard (blank).

2.3.3 Volumetric pipettes—1, 2, and 10 ml.

2.3.4 Transfer pipette—10 ml. with 0.1 ml. divisions.

2.3.5 Volumetric flask—100 ml., one for each sample, and 1,000 ml. for the standard (blank).

2.3.6 Spectrophotometer—To measure absorbance at 420 nm.

2.3.7 Graduated cylinder—100 ml. with 1.0 ml. divisions.

2.3.8 Analytical balance—To measure to 0.1 mg.

3. *Reagents.*

3.1 Sampling.

3.1.1 Absorbing solution—Add 2.8 ml. of concentrated H_2SO_4 to 1 liter of distilled water. Mix well and add 6 ml. of 3 percent hydrogen peroxide. Prepare a fresh solution weekly and do not expose to extreme heat or direct sunlight.

3.2 Sample recovery.

3.2.1 Sodium hydroxide (1*N*)—Dissolve 40 g. NaOH in distilled water and dilute to 1 liter.

3.2.2 Red litmus paper.

3.2.3 Water—Deionized, distilled.

3.3 Analysis.

3.3.1 Fuming sulfuric acid—15 to 18% by weight free sulfur trioxide.

3.3.2 Phenol—White solid reagent grade.

3.3.3 Sulfuric acid—Concentrated reagent grade.

3.3.4 Standard solution—Dissolve 0.5495 g. potassium nitrate (KNO_3) in distilled water and dilute to 1 liter. For the working standard solution, dilute 10 ml. of the resulting solution to 100 ml. with distilled water. One ml. of the working standard solution is equivalent to 25 μg. nitrogen dioxide.

3.3.5 Water—Deionized, distilled.

3.3.6 Phenoldisulfonic acid solution—Dissolve 25 g. of pure white phenol in 150 ml. concentrated sulfuric acid on a steam bath. Cool, add 75 ml. fuming sulfuric acid, and heat at 100° C. for 2 hours. Store in a dark, stoppered bottle.

4. *Procedure.*

4.1 Sampling.

4.1.1 Pipette 25 ml. of absorbing solution into a sample flask. Insert the flask valve stopper into the flask with the valve in the "purge" position. Assemble the sampling train as shown in Figure 7-1 and place the probe at the sampling point. Turn the flask valve and the pump valve to their "evacuate" positions. Evacuate the flask to at least 3 inches Hg absolute pressure. Turn the pump valve to its "vent" position and turn off the pump. Check the manometer for any fluctuation in the mercury level. If there is a visible change over the span of one minute, check for leaks. Record the initial volume, temperature, and barometric pressure. Turn the flask valve to its "purge" position, and then do the same with the pump valve. Purge the probe and the vacuum tube using the squeeze bulb. If condensation occurs in the probe and flask valve area, heat the probe and purge until the condensation disappears. Then turn the pump valve to its "vent" position. Turn the flask valve to its "sample" position and allow sample to enter the flask for about 15 seconds. After collecting the sample, turn the flask valve to its "purge" position and disconnect the flask from the sampling train. Shake the flask for 5 minutes.

4.2 Sample recovery.

4.2.1 Let the flask set for a minimum of 16 hours and then shake the contents for 2 minutes. Connect the flask to a mercury filled U-tube manometer, open the valve from the flask to the manometer, and record the flask pressure and temperature along with the barometric pressure. Transfer the flask contents to a container for shipment or to a 250 ml. beaker for analysis. Rinse the flask with two portions of distilled water (approximately 10 ml.) and add rinse water to the sample. For a blank use 25 ml. of absorbing solution and the same volume of distilled water as used in rinsing the flask. Prior to shipping or analysis, add sodium hydroxide (1*N*) dropwise into both the sample and the blank until alkaline to litmus paper (about 25 to 35 drops in each).

4.3 Analysis.

4.3.1 If the sample has been shipped in a container, transfer the contents to a 250 ml. beaker using a small amount of distilled water. Evaporate the solution to dryness on a steam bath and then cool. Add 2 ml. phenoldisulfonic acid solution to the dried residue and triturate thoroughly with a glass rod. Make sure the solution contacts all the residue. Add 1 ml. distilled water and four drops of concentrated sulfuric acid. Heat the solution on a steam bath for 3 minutes with occasional stirring. Cool, add 20 ml. distilled water, mix well by stirring, and add concentrated ammonium hydroxide dropwise with constant stirring until alkaline to litmus paper. Transfer the solution to a 100 ml. volumetric flask and wash the beaker three times with 4 to 5 ml. portions of distilled water. Dilute to the mark and mix thoroughly. If the sample contains solids, transfer a portion of the solution to a clean, dry centrifuge tube, and centrifuge, or filter a portion of the solution. Measure the absorbance of each sample at 420 nm. using the blank solution as a zero. Dilute the sample and the blank with a suitable amount of distilled water if absorbance falls outside the range of calibration.

5. *Calibration.*

5.1 Flask volume. Assemble the flask and flask valve and fill with water to the stopcock. Measure the volume of water to ±10 ml. Number and record the volume on the flask.

5.2 Spectrophotometer. Add 0.0 to 16.0 ml. of standard solution to a series of beakers. To each beaker add 25 ml. of absorbing solution and add sodium hydroxide (1*N*) dropwise until alkaline to litmus paper (about 25 to 35 drops). Follow the analysis procedure of section 4.3 to collect enough data to draw a calibration curve of concentration in μg. NO_2 per sample versus absorbance.

6. *Calculations.*

6.1 Sample volume.

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[1] Trade name.

$$V_{sc}=\frac{T_{std}(V_f-V_a)}{P_{std}}\left(\frac{P_f}{T_f}-\frac{P_i}{T_i}\right)=\left(17.71\frac{^\circ R}{\text{in. Hg}}\right)(V_f-25\text{ ml.})\left(\frac{P_f}{T_f}-\frac{P_i}{T_i}\right)$$ Equation 7-1

where:

V_{sc}—Sample volume at standard conditions (dry basis), ml.
T_{std}—Absolute temperature at standard conditions, 530° R.
P_{std}—Pressure at standard conditions, 29.92 inches Hg.
V_f—Volume of flask and valve, ml.
V_a—Volume of absorbing solution, 25 ml.
P_f—Final absolute pressure of flask, inches Hg.
P_i—Initial absolute pressure of flask, inches Hg.
T_f—Final absolute temperature of flask, °R.
T_i—Initial absolute temperature of flask, °R.

6.2 Sample concentration. Read μg. NO_2 for each sample from the plot of μg. NO_2 versus absorbance.

$$C=\left(\frac{m}{V_{sc}}\right)\left(\frac{\frac{1\text{ lb.}}{\text{cu. ft.}}}{1.6\times10^{4}\frac{\mu\text{g.}}{\text{ml.}}}\right)=\left(6.2\times10^{-5}\frac{\text{lb./s.c.f.}}{\mu\text{g./ml.}}\right)\left(\frac{m}{V_{sc}}\right)$$ equation 7-2

where:

C—Concentration of NO_x as NO_2 (dry basis), lb./s.c.f.
m—Mass of NO_2 in gas sample, μg.
V_{sc}—Sample volume at standard conditions (dry basis), ml.

7. *References.*

Standard Methods of Chemical Analysis. 6th ed. New York, D. Van Nostrand Co., Inc., 1962, vol. 1, p. 329–330.

Standard Method of Test for Oxides of Nitrogen in Gaseous Combustion Products (Phenoldisulfonic Acid Procedure), In: 1968 Book of ASTM Standards, Part 23, Philadelphia, Pa. 1968, ASTM Designation D–1608–60, p. 725–729.

Jacob, M. B., The Chemical Analysis of Air Pollutants, New York, N.Y., Interscience Publishers, Inc., 1960, vol. 10, p. 351–356.

METHOD 8—DETERMINATION OF SULFURIC ACID MIST AND SULFUR DIOXIDE EMISSIONS FROM STATIONARY SOURCES

1. *Principle and applicability.*

1.1 Principle. A gas sample is extracted from a sampling point in the stack and the acid mist including sulfur trioxide is separated from sulfur dioxide. Both fractions are measured separately by the barium-thorin titration method.

1.2 Applicability. This method is applicable to determination of sulfuric acid mist (including sulfur trioxide) and sulfur dioxide from stationary sources only when specified by the test procedures for determining compliance with the New Source Performance Standards.

2. *Apparatus.*

2.1 Sampling. See Figure 8–1. Many of the design specifications of this sampling train are described in APTD–0581.

2.1.1 Nozzle—Stainless steel (316) with sharp, tapered leading edge.

2.1.2 Probe—Pyrex[1] glass with a heating system to prevent visible condensation during sampling.

2.1.3 Pitot tube—Type S, or equivalent, attached to probe to monitor stack gas velocity.

2.1.4 Filter holder—Pyrex[1] glass.

2.1.5 Impingers—Four as shown in Figure 8–1. The first and third are of the Greenburg-Smith design with standard tip. The second and fourth are of the Greenburg-Smith design, modified by replacing the standard tip with a ½-inch ID glass tube extending to one-half inch from the bottom of the impinger flask. Similar collection systems, which have been approved by the Administrator, may be used.

2.1.6 Metering system—Vacuum gauge, leak-free pump, thermometers capable of measuring temperature to within 5° F., dry gas meter with 2% accuracy, and related equipment, or equivalent, as required to maintain an isokinetic sampling rate and to determine sample volume.

2.1.7 Barometer—To measure atmospheric pressure to ±0.1 inch Hg.

2.2 Sample recovery.
2.2.1 Wash bottles—Two.
2.2.2 Graduated cylinders—250 ml., 500 ml.
2.2.3 Glass sample storage containers.
2.2.4 Graduated cylinder—250 ml.
2.3 Analysis.
2.3.1 Pipette—25 ml., 100 ml.
2.3.2 Burette—50 ml.
2.3.3 Erlenmeyer flask—250 ml.
2.3.4 Graduated cylinder—100 ml.
2.3.5 Trip balance—300 g. capacity, to measure to ±0.05 g.
2.3.6 Dropping bottle—to add indicator solution.

3. *Reagents.*

3.1 Sampling.

3.1.1 Filters—Glass fiber, MSA type 1106 BH, or equivalent, of a suitable size to fit in the filter holder.

3.1.2 Silica gel—Indicating type, 6–16 mesh, dried at 175° C. (350° F.) for 2 hours.

3.1.3 Water—Deionized, distilled.

3.1.4 Isopropanol, 80%—Mix 800 ml. of isopropanol with 200 ml. of deionized, distilled water.

3.1.5 Hydrogen peroxide, 3%—Dilute 100 ml. of 30% hydrogen peroxide to 1 liter with deionized, distilled water.

3.1.6 Crushed ice.
3.2 Sample recovery.
3.2.1 Water—Deionized, distilled.
3.2.2 Isopropanol, 80%.
3.3 Analysis.
3.3.1 Water—Deionized, distilled.
3.3.2 Isopropanol.

3.3.3 Thorin indicator—1-(o-arsonophenylazo)-2-naphthol-3, 6-disulfonic acid, disodium salt (or equivalent). Dissolve 0.20 g. in 100 ml. distilled water.

3.3.4 Barium perchlorate (0.01*N*)—Dissolve 1.95 g. of barium perchlorate $[Ba(CO_4)_2 \cdot 3\,H_2O]$ in 200 ml. distilled water and dilute to 1 liter with isopropanol. Standardize with sulfuric acid.

3.3.5 Sulfuric acid standard (0.01*N*)—Purchase or standardize to ± 0.0002 *N* against 0.01 *N* NaOH which has previously been standardized against primary standard potassium acid phthalate.

4. *Procedure.*

4.1 Sampling.

4.1.1 After selecting the sampling site and the minimum number of sampling points, determine the stack pressure, temperature, moisture, and range of velocity head.

4.1.2 Preparation of collection train. Place 100 ml. of 80% isopropanol in the first impinger, 100 ml. of 3% hydrogen peroxide in both the second and third impingers, and about 200 g. of silica gel in the fourth impinger. Retain a portion of the reagents for use as blank solutions. Assemble the train without the probe as shown in Figure 8–1 with the filter between the first and second impingers. Leak check the sampling train at the sampling site by plugging the inlet to the first impinger and pulling a 15-inch Hg vacuum. A leakage rate not in excess of 0.02 c.f.m. at a vacuum of 15 inches Hg is acceptable. Attach the probe and turn on the probe heating system. Adjust the probe heater setting during sampling to prevent any visible condensation. Place crushed ice around the impingers. Add more ice during the run to keep the temperature of the gases leaving the last impinger at 70° F. or less.

4.1.3 Train operation. For each run, record the data required on the example sheet shown in Figure 8–2. Take readings at each sampling point at least every 5 minutes and when significant changes in stack conditions necessitate additional adjustments in flow rate. To begin sampling, position the nozzle at the first traverse point with the tip pointing directly into the gas stream. Start the pump and immediately adjust the flow to isokinetic conditions. Maintain isokinetic sampling throughout the sampling period. Nomographs are available which aid in the

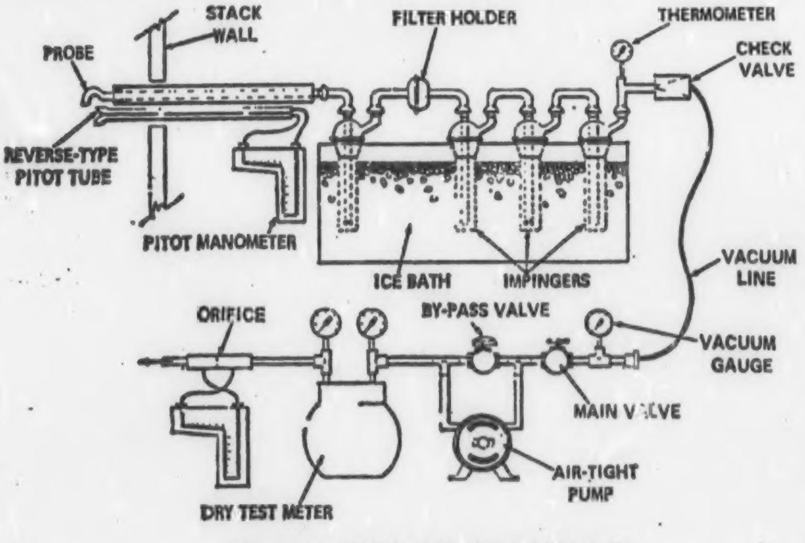

Figure 8-1. Sulfuric acid mist sampling train.

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[1] Trade name.

rapid adjustment of the sampling rate without other computations. APTD-0576 details the procedure for using these nomographs. At the conclusion of each run, turn off the pump and record the final readings. Remove the probe from the stack and disconnect it from the train. Drain the ice bath and purge the remaining part of the train by drawing clean ambient air through the system for 15 minutes.

PLANT__________
LOCATION__________
OPERATOR__________
DATE__________
RUN NO.__________
SAMPLE BOX NO.__________
METER BOX NO.__________
METER $\Delta H_@$__________
C FACTOR__________

SCHEMATIC OF STACK CROSS SECTION

AMBIENT TEMPERATURE__________
BAROMETRIC PRESSURE__________
ASSUMED MOISTURE, %__________
HEATER BOX SETTING__________
PROBE LENGTH, m.__________
NOZZLE DIAMETER, in.__________
PROBE HEATER SETTING__________

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min.	STATIC PRESSURE (P_s), in. Hg.	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH), in. H_2O	GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER		SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F
							INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F		
TOTAL							Avg.	Avg.		
AVERAGE							Avg.			

Figure 8-2. Field data.

4.2 Sample recovery.

4.2.1 Transfer the isopropanol from the first impinger to a 250 ml. graduated cylinder. Rinse the probe, first impinger, and all connecting glassware before the filter with 80% isopropanol. Add the rinse solution to the cylinder. Dilute to 250 ml. with 80% isopropanol. Add the filter to the solution, mix, and transfer to a suitable storage container. Transfer the solution from the second and third impingers to a 500 ml. graduated cylinder. Rinse all glassware between the filter and silica gel impinger with deionized, distilled water and add this rinse water to the cylinder. Dilute to a volume of 500 ml. with deionized, distilled water. Transfer the solution to a suitable storage container.

4.3 Analysis.

4.3.1 Shake the container holding isopropanol and the filter. If the filter breaks up, allow the fragments to settle for a few minutes before removing a sample. Pipette a 100 ml. aliquot of sample into a 250 ml. Erlenmeyer flask and add 2 to 4 drops of thorin indicator. Titrate the sample with barium perchlorate to a pink end point. Make sure to record volumes. Repeat the titration with a second aliquot of sample. Shake the container holding the contents of the second and third impingers. Pipette a 25 ml. aliquot of sample into a 250 ml. Erlenmeyer flask. Add 100 ml. of isopropanol and 2 to 4 drops of thorin indicator. Titrate the sample with barium perchlorate to a pink end point. Repeat the titration with a second aliquot of sample. Titrate the blanks in the same manner as the samples.

5. *Calibration.*

5.1 Use standard methods and equipment which have been approved by the Administrator to calibrate the orifice meter, pitot tube, dry gas meter, and probe heater.

5.2 Standardize the barium perchlorate with 25 ml. of standard sulfuric acid containing 100 ml. of isopropanol.

6. *Calculations.*

6.1 Dry gas volume. Correct the sample volume measured by the dry gas meter to standard conditions (70° F., 29.92 inches Hg) by using Equation 8-1.

$$V_{m_{std}}=V_m\left(\frac{T_{std}}{T_m}\right)\left(\frac{P_{bar}+\frac{\Delta H}{13.6}}{P_{std}}\right)=\left(17.71\frac{°R}{\text{in. Hg}}\right)V_m\left(\frac{P_{bar}+\frac{\Delta H}{13.6}}{T_m}\right)$$

equation 8-1

where:

$V_{m_{std}}$ = Volume of gas sample through the dry gas meter (standard conditions), cu. ft.

V_m = Volume of gas sample through the dry gas meter (meter conditions), cu. ft.

T_{std} = Absolute temperature at standard conditions, 530° R.

T_m = Average dry gas meter temperature, °R.

P_{bar} = Barometric pressure at the orifice meter, inches Hg.

ΔH = Pressure drop across the orifice meter, inches H_2O.

13.6 = Specific gravity of mercury.

P_{std} = Absolute pressure at standard conditions, 29.92 inches Hg.

6.2 Sulfuric acid concentration.

$$C_{H_2SO_4}=\left(1.08\times10^{-4}\frac{\text{lb.-l.}}{\text{g.-ml.}}\right)\frac{(V_t-V_{tb})(N)\left(\frac{V_{soln}}{V_a}\right)}{V_{m_{std}}}$$

equation 8-2

$C_{H_2SO_4}$ = Concentration of sulfuric acid at standard conditions, dry basis, lb./cu. ft.

1.08×10^{-4} = Conversion factor including the number of grams per gram equivalent of sulfuric acid (49 g./g.-eq.), 453.6 g./lb., and 1,000 ml./l., lb.-l./g.-ml.

V_t = Volume of barium perchlorate titrant used for the sample, ml.

V_{tb} = Volume of barium perchlorate titrant used for the blank, ml.

N = Normality of barium perchlorate titrant, g.-eq./l.

V_{soln} = Total solution volume of sulfuric acid (first impinger and filter), ml.

V_a = Volume of sample aliquot titrated, ml.

$V_{m_{std}}$ = Volume of gas sample through the dry gas meter (standard conditions), cu. ft., see Equation 8-1.

6.3 Sulfur dioxide concentration.

$$C_{SO_2}=\left(7.05\times10^{-5}\frac{\text{lb.-l.}}{\text{g.-ml.}}\right)\frac{(V_t-V_{tb})(N)\left(\frac{V_{soln}}{V_a}\right)}{V_{m_{std}}}$$

equation 8-3

where:

C_{SO_2} = Concentration of sulfur dioxide at standard conditions, dry basis, lb./cu. ft.

7.05×10^{-5} = Conversion factor including the number of grams per gram equivalent of sulfur dioxide (32 g./g.-eq.) 453.6 g./lb., and 1,000 ml./l., lb.-l./g.-ml.

V_t = Volume of barium perchlorate titrant used for the sample, ml.

V_{tb} = Volume of barium perchlorate titrant used for the blank, ml.

N = Normality of barium perchlorate titrant, g.-eq./l.

V_{soln} = Total solution volume of sulfur dioxide (second and third impingers), ml.

V = Volume of sample aliquot titrated, ml.

$V_{m_{std}}$ = Volume of gas sample through the dry gas meter (standard conditions), cu. ft., see Equation 8-1.

7. *References.*

Atmospheric Emissions from Sulfuric Acid Manufacturing Processes, U.S. DHEW, PHS, Division of Air Pollution, Public Health Service Publication No. 999-AP-13, Cincinnati, Ohio, 1965.

Corbett, D. F., The Determination of SO_2 and SO_3 in Flue Gases, Journal of the Institute of Fuel, 24:237-243, 1961.

Martin, Robert M., Construction Details of Isokinetic Source Sampling Equipment, Environmental Protection Agency, Air Pollution Control Office Publication No. APTD-0581.

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Rom, Jerome J., Maintenance, Calibration, and Operation of Isokinetic Source Sampling Equipment, Environmental Protection Agency, Air Pollution Control Office Publication No. APTD–0576.

Shell Development Co. Analytical Department, Determination of Sulfur Dioxide and Sulfur Trioxide in Stack Gases, Emeryville Method Series, 4516/59a.

METHOD 9—VISUAL DETERMINATION OF THE OPACITY OF EMISSIONS FROM STATIONARY SOURCES

1. *Principle and applicability.*

1.1 Principle. The relative opacity of an emission from a stationary source is determined visually by a qualified observer.

1.2 Applicability. This method is applicable for the determination of the relative opacity of visible emissions from stationary sources only when specified by test procedures for determining compliance with the New Source Performance Standards.

2. *Procedure.*

2.1 The qualified observer stands at approximately two stack heights, but not more than a quarter of a mile from the base of the stack with the sun to his back. From a vantage point perpendicular to the plume, the observer studies the point of greatest opacity in the plume. The data required in Figure 9–1 is recorded every 15 to 30 seconds to the nearest 5% opacity. A minimum of 25 readings is taken.

3. *Qualifications.*

3.1 To certify as an observer, a candidate must complete a smokereading course conducted by EPA, or equivalent; in order to certify the candidate must assign opacity readings in 5% increments to 25 different black plumes and 25 different white plumes, with an error not to exceed 15 percent on any one reading and an average error not to exceed 7.5 percent in each category. The smoke generator used to qualify the observers must be equipped with a calibrated smoke indicator or light transmission meter located in the source stack if the smoke generator is to determine the actual opacity of the emissions. All qualified observers must pass this test every 6 months in order to remain certified.

4. *Calculations.*

4.1 Determine the average opacity.

5. *References.*

Air Pollution Control District Rules and Regulations, Los Angeles County Air Pollution Control District, Chapter 2, Schedule 6, Regulation 4, Prohibition, Rule 50, 17 p.

Kudluk, Rudolf, Ringelmann Smoke Chart, U.S. Department of Interior, Bureau of Mines, Information Circular No. 8333, May 1967.

SEC / MIN	0	15	30	45	SEC / MIN	0	15	30	45
0					30				
1					31				
2					32				
3					33				
4					34				
5					35				
6					36				
7					37				
8					38				
9					39				
10					40				
11					41				
12					42				
13					43				
14					44				
15					45				
16					46				
17					47				
18					48				
19					49				
20					50				
21					51				
22					52				
23					53				
24					54				
25					55				
26					56				
27					57				
28					58				
29					59				

Observation data

Plant ____________________

Stack location ____________________

Observer ____________________

Date ____________________

Time ____________________

Distance to stack ____________________

Wind direction ____________________

Wind speed ____________________

Sum of numbers recorded ____________________

Total number of readings ____________________

$$\text{Opacity} = \frac{\text{Sum of nos. recorded}}{\text{Total no. readings}}$$

= ____________________

Figure 9-1. Field data.

[FR Doc.71-18624 Filed 12-22-71;8:45 am]

1A

STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Supplemental Statement in Connection With Final Promulgation

I. EPA published Standards of Performance for New Stationary Sources in final form, prefaced by a "concise general statement of their basis and purpose" as required by section 4(c) of the Administrative Procedure Act, 5 U.S.C. 553(c), on December 23, 1971. 36 F.R. 24876. Petitions for review of certain of these standards were filed on January 21 and 24 by the Essex Chemical Corp. et al., the Portland Cement Association, and the Appalachian Power Co. et al. (U.S. Court of Appeals for the District of Columbia, Nos. 72-1072, 72-1073, and 72-1079).

On February 18, 1972, almost 2 months after EPA published the New Stationary Source Standards, the U.S. Court of Appeals for the District of Columbia Circuit handed down its decision in "Kennecott Copper Corp. v. Environmental Protection Agency" (C.A.D.C. No. 71-1410), which concerned a national secondary ambient air quality standard promulgated by EPA pursuant to section 109(b) of the Clean Air Amendments of 1970, 42 U.S.C. 1857C-4(b). The court there held that although the "concise general statement" prefacing the standard involved satisfied the requirements of section 4(c) of the Administrative Procedure Act, it would nonetheless remand the cause to the Administrator for a more specific explanation of how he had arrived at the standard.

In light of the decision in "Kennecott Copper," and in the interest of a speedy judicial determination of the validity of the Standards of Performance for New Stationary Sources, we have prepared this statement of the basis of the Administrator's decision to promulgate the standards to supplement that appearing as the preface to the final standards as published in December 1971. Although if the point were raised it might ultimately be determined that this statement was not necessary to satisfy the doctrine expressed by the "Kennecott Copper" opinion, EPA considers it fundamental to the national policy embodied in the Clean Air Amendments of 1970 to expedite all steps of promulgation and enforcement of standards and implementation plans to bring about clean air. The speedy eradication of any uncertainty as to the validity of the standards for new stationary sources is an important part of this process. Accordingly, considering the particular sequence of events and pressures of time involved here, we think it most appropriate to include this supplementary statement in the record now, thereby ensuring the rapid conclusion of judicial review of the validity of the standards.

II. 1. *The Particulate Test Method.* Particulate emission limits were proposed for steam generators, incinerators, and cement plants, based on measurements made with the full EPA sampling train, which includes a dry filter as well as impingers, which contain water and act as condensers and scrubbers. In the impingers the gases are cooled to about 70° F. before metering.

There were objections to the use of impingers in the EPA sampling train, with suggestions that the particulate standards be based either on the "front half" (probe and filter) of the EPA sampling train or on the American Society of Mechanical Engineers test procedure. Both of these methods measure only those materials that are solids or liquids at 250° F. and greater temperatures.

It is the opinion of EPA engineers that particulate standards based either on the front half or the full EPA sampling train will require the same degree of control if appropriate limits are applied. Analyses by EPA show that the material collected in the impingers of the sampling train is usually although not in every case a consistent fraction of the total particulate loading. Nevertheless, there is some question that all of the material collected in the impingers would truly form particulates in the atmosphere under normal dispersion conditions. For instance, gaseous sulfur dioxide may be oxidized to a particulate form—sulfur trioxide and sulfuric acid—in the sampling train. Much of the material found in the impingers is sulfuric acid and sulfates. There has been only limited sampling with the full EPA train such that the occasional anomalies cannot be explained fully at this time. In any case, the front half of the EPA train is considered a more acceptable means of measuring filterable particulates than the ASME method in that a more efficient filter is required and the filter has far less mass than the principal ASME filter in relation to the sample collected. The latter position was reinforced by a recommendation of the Air Pollution Control Association.

Accordingly, we determined that, for the three affected source categories, steam generators, incinerators, and cement plants, particulate standards should be based on the front half of the EPA sampling train with mass emission limits adjusted as follows:

	Originally proposed particulate standards, full EPA train	Recommended particulate standards revised sample method (front half only)
Steam Generators—pounds per million Btu heat input	0.20	0.10
Incinerators—grains per standard cubic foot at 12 percent CO_2	0.10	0.08
Cement Kilns—pounds per ton feed	0.30	0.30
Cement Coolers—pounds per ton feed	0.10	0.10

The adjusted standards are based on EPA sampling results and are designed to provide the same degree of control as the originally proposed standards. In the case of steam generators, the installations which were found to be best controlled showed reasonably large concentrations (about 50 percent) of materials in the impingers. The five incinerator tests which showed compliance with the originally proposed standard all indicated impinger catches of 20 to 30 percent. All five of these tests indicate compliance with the original and the revised standard.

In the case of cement plants, holding to the same allowable emission rate while changing the sampling method results in a slight relaxation of the standard. This permits an electrostatic precipitator as well as a fabric filter to meet the emission standard.

2. *The Sulfur Dioxide Standard for Steam Generators of 1.2 Pounds Per Million B.T.U. Heat Input.* The Administrator took into account the following facts in determining that there has been adequate demonstration of the achievability of the standard.

There are at present three SO_2 removal systems in operation at U.S. power stations. Moreover, a total of 13 electric power companies have contracted for the construction of seventeen additional units, most of which will become operational in the next 2 years. Most of these employ lime or limestone scrubbing, but magnesium oxide and sodium hydroxide scrubbing and catalytic oxidation also will be used. In addition, seven units will be equipped with water scrubbers for fly ash collection in the anticipation that they may be converted to SO_2 removal in the future. Eight different firms are designing the installations. One of the installations, a sodium hydroxide scrubber, is guaranteed by the designer to achieve 90 percent or better SO_2 removal. Four others are guaranteed at 80 percent or better. Table I summarizes information about these installations. Generally, the standard of 1.2 pounds of sulfur dioxide per million B.t.u. input can be met by the removal of 70-75 percent of the sulfur dioxide formed in the burning of coal of average sulfur content (i.e., 2.8-3 percent).

A 125-megawatt unit now operated by the Kansas Power and Light Co. at Lawrence, Kans., was put into operation in December 1968. Several problems were experienced originally and appreciable revisions have been made to improve the system. The most successful operation of the scrubber has occurred during 1971.

In some respects the plant is atypical in that it is not required to burn coal continually. Natural gas is available much of the time, and the station also has a supply of fuel oil that can be burned in emergencies when natural gas is not available. Kansas Power and Light has used this flexibility to advantage in the operation of the scrubber. It frequently switches the unit from coal to natural gas, bypassing the scrubber, so that they can inspect the internals for possible malfunction. The generating unit was seldom operated longer than 4 weeks on coal firing without making such inspections. In most instances, little or no maintenance was required during the outage, and the company then merely inspected the scrubber.

TABLE I—SULFUR DIOXIDE REMOVAL SYSTEMS AT U.S. STEAM-ELECTRIC PLANTS

Power station	Unit size	Designer SO_2 system	New or retro-fit	Scheduled startup	Anticipated efficiency of SO_2 removal
Limestone Scrubbing:	*MW*				
1. Union Electric Co., Meramec No. 2.	140	Combustion Engineer.	R	September 1968	Operated at 73% efficiency during EPA test.
2. Kansas Power & Light, Lawrence Station No. 4.	125	Combustion Engineer.	R	December 1968	Do.
3. Kansas Power & Light, Lawrence Station No. 5.	430	Combustion Engineer.	N	December 1971	Will start at 65% and be upgraded to 80%
4. Kansas City Power & Light, Hawthorne Station No. 3.	100	Combustion Engineer.	R	Late 1972	Guaranteed 70%.
5. Kansas City Power & Light, Hawthorne, Station No. 4.	100	Combustion Engineer.	R	Late 1972	Do.
6. Kansas City Power & Light, Lacygne Station.	800	Babcock & Wilcox	N	Late 1973	80% as target.
7. Detroit Edison Co., St. Clair Station No. 3.	180	Peabody	R	Late 1972	90% as target.
8. Detroit Edison Co., River Rouge Station No. 1.	265	Peabody	R	Late 1972	Do.
9. Commonwealth Edison Co., Will County Station No. 1.	175	Babcock & Wilcox	R	February 1972	Guaranteed 85%.
10. Northern States Power Co., Sherburne County Station, Minn., No. 1.	700	Combustion Engineer.	N	1976	
11. Arizona Public Service, Cholla Station Co.	115	Research Cottrell	R	December 1973	
12. Tennessee Valley Authority, Widow's Creek Station No. 8.	550	Undecided	R	1974-75	
13. Duquesne Light Co., Philips Station.	100	Chemico	R	March 1973	Do.
14. Louisville Gas & Electric Co., Paddy's Run Station.	70	Combustion Engineer.	R	Mid-late 1973	Do.
15. City of Key West, Stock Island.[1]	37	Zurn	N	Early 1973	Guaranteed 80% removal.
16. Union Electric Co., Meramec No. 1.	125	Combustion Engineer.	R	Spring 1973	80% as target.
Sodium Hydroxide Scrubbing Installations:					
1. Nevada Power Co., Reed Gardner Station.	250	Combustion Equipment Associates.	R	1973	Guaranteed 90% SO_2 while burning 1% S coal.
Magnesium Oxide Scrubbing Installations:					
1. Boston Edison Co., Mystic Station No. 6.[2]	150	Chemico	R	February 1972	90% target.
2. Potomac Electric Power, Dickerson No. 3.	195	do	R	Early 1974	90%.
Catalytic Oxidation:					
1. Illinois Power, Wood River[2].	100	Monsanto	R	June 1972	Guaranteed 85% SO_2 removal.

[1] Oil-fired plants (remainder are coal-fired).
[2] Partial EPA funding.

All water from the pond is recycled back to the scrubber. Blowdown from cooling towers constitutes makeup water. The sludge oxidizes to sulfate in the pond. Eventually, sulfate may be removed from the system and taken with the ash to landfills.

The limestone system for the new 430-megawatt steam-electric unit at the Lawrence station is essentially the same as the smaller unit. It has been operated only on a limited basis to date. The company plans to operate at 65 percent SO_2 removal, then upgrade to 80 percent or more based on experience with the 125-megawatt unit. With the new system sulfate crystallization will be accomplished in tanks. The company plans to run clarified liquor from the crystallizers directly back to the scrubbers. A solids content of 6-10 percent will be maintained in the recycle liquor to prevent scaling in exposed surfaces.

Combustion engineering pilot studies. Pilot studies conducted by the Combustion Engineering Co. on a 1 mw. equivalent stream showed 95 percent SO_2 removal with continuous crystallization and 100 percent water recycle from crystallizers. The studies form the basis upon which CE is guaranteeing that its new installations will remove at least 70 percent of SO_2.

Battersea scrubber. The principle of alkaline scrubbing has been demonstrated at the Battersea Power Station in England, where a scrubber has been in use since 1932. A multiple stage process is employed. Alkaline river water is used in the first stage and lime-neutralized liquor in subsequent stages. The steam generator is of 3,500 million B.t.u. rating. Reports indicate that the efficiency of this system exceeds 90 percent when the boiler is fired with 0.8 to 1 percent sulfur coal. Similar systems are in operation on two 150-mw. oil-fired boilers at the Bankside Power Station in England.

Swansea scrubber. Lime scrubbing processes were installed on coal-fired units at the Swansea Power Station and the Fulham Power Station in England prior to World War II. The system at the Fulham Station reportedly operated successfully until shut down for security reasons early during World War II. It was not reactivated after the war. The Swansea installation was operated for about 2 years on a coal-fired power boiler and is not now in service. Unlike the Battersea and Bankside operations, these units utilized a continuous liquid recycle. The systems were reported to operate at SO_2 efficiencies of 90 percent or greater.

Bahco lime scrubbing. The two-stage system has been demonstrated at about 98 percent SO_2 removal over a 6-month period on a 7-mw. oil-fired steam generator in Sweden. The process is now being offered under license in the United States by Research Cottrell. None of the Bahco systems have yet been installed on coal-fired boilers. Nevertheless, the two-stage scheme appears to offer definite advantages over single-stage processes in achieving high removal efficiencies.

Wellman power gas sulfite scrubbing. The sulfite-bisulfite system has been installed on two oil-fired boilers in Japan. The combined capacity is about 650 million B.t.u. per hour. Since it was put into operation in June 1971, removal efficiencies of 95 percent have been reported with exit levels of about 0.2 pounds SO_2 per million B.t.u. The system has not been operated on a coal-fired boiler. However, since precipitators have been shown to remove particulates down to the same level as oil-fired units, application of the sulfite system to coal-fired boilers should be feasible.

A principal difficulty in operating lime based scrubbing systems has been the tendency to form scale on scrubber surfaces. Union Electric, TVA, and to a lesser extent Kansas Power and Light have reported scaling problems. The experience of Kansas Power and Light and European and Japanese installations show that scaling can be held to a tolerable level. Present designs probably will be revised to optimize cost versus scaling. The use of two or more stages would appear desirable for high sulfur coals.

In all probability, there will be some scale formation in all closed circuit lime scrubbing systems for SO_2 abatement. At the Bahco installation as at the Kansas Power and Light installation in the United States, this is minimized by keeping the solution pH in the acid region. In addition to this, a Mitsubishi Heavy Industries pilot plant in Japan has employed seed crystals and a delay tank and was reportedly able to operate for 500 hours without any sign of scaling (i.e., the scaling took place on the seed crystals).

In addition to operating at an acid pH, the Bahco system employs a wide open scrubber that can tolerate appreciable scale deposits. It was reported that the installation of additional spray heads to more thoroughly wash the wetted surfaces at the Bischaff installation in West Germany helped to prevent scale formations.

All three installations cited above have reported successful periods of operation while employing the above-mentioned techniques. The most successful of these is the Bahco unit which has had no serious operational difficulties since November 1969. These examples show that lime systems can be operated without unscheduled shutdown due to scale problems.

3. *Cost of compliance with steam generator standards.* The economic impact of the new source performance standards and requisite pollution control expenditures have been developed for a typical new coal-fired unit of 600-megawatt (MW) capacity. The investment cost for such a plant would be $120 million plus $18 million for sulfur dioxide and particulate control and $1 million for nitrogen oxide control. The $19 million total can be compared to $3.6 million which would have been expended for particulate control if sulfur dioxide and nitrogen oxide abatement were not required.

On an annualized basis the pollution control costs would be 0.13 cents per kw.-hr. for sulfur dioxide and particulate control plus 0.01 cents per kw.-hr. for nitrogen oxide control. Particulate control alone would cost 0.01 cents per kw.-hr. An average revenue of 1.56 cents per kw.-hr, is assumed. Based on these figures, the cost of pollution control will be about 9 percent of the delivered cost of electricity if all plants operated by the utility in question had to incur a comparable cost. Using a figure of $130 per year as the average residential electric bill, the increased cost of electricity to a residential customer would be about $1 per month if the total cost of control is passed on to the customer.

An indication of the impact of increased electricity cost on industrial consumers may be obtained by examining the relationship of electricity cost to production costs. An upper limit may be approximated by considering the aluminum industry, a large consumer of electrical energy. If the aluminum industry were to incur an increase of nine percent in electricity cost, production costs would increase by about 1.4 percent. Although aluminum smelters usually consume hydroelectric power and would not realize pollution control costs increases, nonetheless, the figures show that even for a large consumer the impact of increased electricity cost is fairly small. In general, the estimated electricity cost increase will have only a minor impact on production costs.

Each year the power industry puts into operation about 49 new steam-electric units. On the average, 29 are fired with coal, seven with oil, and 13 with natural gas. Most of the oil-fired units and a few of the coal-fired units may burn low sulfur fuel. The number requiring flue gas desulfurization is estimated to be between 20 and 30 per year. Most of these, 15 to 20, will be located east of the Mississippi River.

The foregoing cost projections are based on estimated costs of $30 per installed kilowatt for sulfur dioxide scrubbing systems which will also be capable of controlling coal particulate to the level of the standard. Some power distributors have questioned the figure and suggest that the actual cost may be close to $70 per kw. Nevertheless, a review of applicable cost estimates for calcium base SO_2 scrubbing system shows support for the EPA estimate.

The four estimates listed in table II for new plants range from $18.7 to $25.67 per kw. Three of the plants are large—680 to 1,000 mw. All five estimates for retrofitting existing plants show greater cost, ranging from $28.6 to $61.8 per kw. The retrofit estimates tend to cover smaller steam generators, only one of the five being greater than 180 mw. In addition, the retrofit costs tend to reflect unusual circumstances which would not be expected at new plants. All are closed circuit limestone or calcium hydroxide systems except for the small unit at Key West, Fla. In the closed circuit system, all waters are recycled to avoid problems of liquid and solid waste disposal.

TABLE II

COST ESTIMATES FOR EQUIPPING COAL FIRED STEAM-ELECTRIC PLANTS WITH CALCIUM BASE SCRUBBING SYSTEMS (1971 ESTIMATES)

Source of estimate	Size	Capital cost
Zurn Industries (Key West installation).	57 MW (New).	$20.4/kw.
Northern States Power Co..	2–680 MW (New).	$18.7/kw.
Babcock & Wilcox (Hypothetical plant in midwest).	800 MW (New).	$25.67/kw.
Tennessee Valley Authority.	1000 MW (New).	$19.20/kw.
Do.	550 MW (Retrofit).	$54.5 to $61.8/kw.
Louisville Gas & Electric Co.	70 MW (Retrofit).	$28.6/kw.
Duquesne Light Co.	100 MW (Retrofit).	$35/kw.
Commonwealth Edison Co.	175 MW (Retrofit).	$49/kw.
Detroit Edison Co.	4–180 MW (Retrofit).	$49.6/kw.

Projected capital costs for nitrogen control will range from nil to $3.50 per kw. The greatest cost will be incurred from those units which will use combinations of flue gas recirculation and off-stoichiometric combustion to achieve the standard. Many of these will be gas-fired boilers which will not have to expend any capital for sulfur dioxide or particulate control. The least cost will be for corner-fired coal burning boilers which should be able to meet the standards without any modification. Corner-fired units are sold by only one of the four major U.S. power boiler manufacturers. The other three firms have experience with nitrogen oxide reduction schemes for gas and oil burning but it is uncertain what methods they will employ with coal burning. Consequently, precise costs are uncertain, but it is expected that the nitrogen oxide standard will stimulate interest in combustion techniques which can achieve the required emission levels at little or no increase in cost.

4. *The nitrogen oxide standard for coal-fired steam generators.* The standards set an emission limit of 0.7 pound of nitrogen oxide per million B.t.u. coal-fired steam generators. This is roughly equivalent to a stack gas concentration of 550 parts per million for a bituminous-fired operation. Several electric utilities and three of the four major boiler manufacturers commented that the technology was not fully demonstrated to achieve the standard.

The coal standard is based principally on nitrogen oxide levels achieved with corner-fired boilers which are manufactured by only one company—Combustion Engineering. This firm has confirmed in writing that it will guarantee to meet the nitrogen oxide standard. Investigations by an EPA contractor showed that other types of boilers could meet the standard under modified burning conditions. In fact, two of the three remaining companies have informed EPA they will guarantee that their new installations will meet the EPA standard of 0.7 pound/million B.t.u. on new installations.

5. *Particulate standards for kilns in portland cement plants.* Particulate emission limits of 0.3 pound per ton of feed to the kiln were proposed for cement kilns. This is roughly equivalent to a stack gas concentration of 0.03 grains per standard cubic foot.

The Portland Cement Association, American Mining Congress, a local control agency and the major cement producers commented that the kiln standard was either too strict or it is not based on adequately demonstrated technology, i.e. fabric filters can not be used for all types of cement plants. On the other hand, a comment was received from an equipment manufacturer stating that equipment other than fabric filters also can be used to meet the standard and citing supportive data for electrostatic precipitators. In addition, the AMC, a local agency and cement producers commented that the particulate standards for cement kilns are stricter than those promulgated for power plants and municipal incinerators. Further they objected to the test method to be used to determine compliance.

The proposed standard was based principally on particulate levels achieved at a kiln controlled by a fabric filter. Several other kilns controlled by fabric filters had no visible emissions but could not be tested due to the physical layout of the equipment. After proposal, but prior to promulgation a second kiln controlled by a fabric filter was tested and found to have particulate emissions in excess of the proposed standard. However, based on the revised particulate test method, the second installation showed particulate emissions to be less than 0.3 pound per ton of kiln feed.

The promulgated standard is roughly equivalent to a stack gas concentration of 0.03 grains per standard cubic foot. The power plant standard is equivalent to 0.06 grains per standard cubic foot at normal excess air rates. The incinerators standard is 0.08 grains per standard cubic foot corrected to 12 percent carbon dioxide. Uncorrected, at normal conditions of 7.5 percent carbon dioxide it is equivalent to 0.05 grains per standard cubic foot. The difference between the particulate standard for cement plants and those for steam generators and incinerators is attributable to the superior technology available therefor (that is, fabric filter technology has not been applied to coal-fired steam generators or incinerators).

In sum, considering the revision of the particulate test method, there are sufficient data to indicate that cement plants equipped with fabric filters and precipitators can meet the standard.

6. *Cost of achieving particulate standard for kilns at portland cement plants.* A limit of 0.3 pounds per ton of feed to the kiln was proposed. The limit applies to all new wet or dry process cement kilns.

Three cement producers commented that a well-controlled plant would cost much more than indicated by EPA. A meeting between American Mining Congress and EPA revealed that that association felt the cost of an uncontrolled cement plant as reported by EPA was low by a factor of 1.5 to 2. However, the association agreed that EPA had accurately estimated the cost of the pollution control equipment itself. Accordingly, no change in the standard was warranted on account of cost. Indeed, if the industry is correct in asserting that the cost of an uncontrolled plant is higher than that estimated by EPA, that means that the cost of pollution control expressed as a percentage of total cost is less than the 12 percent figure cited in the background document, APTD-0711, which was distributed by EPA at the time the standards were proposed.

7. *Sulfur dioxide and acid mist standards for sulfuric acid plants.* Sulfur dioxide emission limits of 4 pounds per ton of acid produced and acid mist emission limits of 0.15 pounds per ton of acid produced were proposed for sulfuric acid plants.

Several sulfuric acid manufacturers and the Manufacturing Chemists Association commented that the proposed SO_2 standard is unattainable in day-to-day operation at one of the plants tested or that it is unduly restrictive. They asserted that to meet the standard, the plant would have to be "designed to 2 pounds per ton" to allow for the inevitable gradual loss of conversion efficiency during a period of operation, and that units capable of such performance have not been demonstrated in this country. Essentially, the same parties commented that there is published data showing that due to the vapor pressure of sulfuric acid, the acid mist standard is not attainable.

The proposed standard was based principally on sulfur dioxide levels achieved with dual absorption acid plants and one single absorption plant controlling emissions with a sodium sulfite SO_2 recovery system. There are only three dual absorption plants in this country. Company emission data at one of the plants tested indicates the plant was meeting the proposed standard for a year of operation when the production rate was less than 600 tons per day. The plant is rated at 700 tons per day. At the second U.S. plant, emissions were about 2 pounds per ton about two months after startup. Discussion with foreign dual absorption plant designers and operators indicates normal operation at 99.8 percent conversion or higher for 99 percent of the time over a period of years. This conversion efficiency is equivalent to approximately 2.5 pounds per ton of acid produced.

Complaints from the industry that it cannot meet the acid mist standard appear to be based on experience with other test methods than EPA's. Such other methods measure more sulfur trioxide and acid vapor, in addition to acid mist, than does the EPA method. Tests of several plants with the EPA test method have shown acid mist emissions well below the emission limits as set in the standards.

8. *Cost of achieving sulfur dioxide standard at sulfuric acid plants.* A limit of 4 pounds of sulfur dioxide per ton of acid produced is set by the regulation. The limit applies to all types of new contact acid plants except those operated for control purposes, as at smelters.

The sulfuric acid industry has commented that (1) the cost of achieving the proposed sulfur dioxide standard is about three times the EPA estimate, and (2) promulgation of a standard 60 percent less restrictive than proposed by EPA would reduce the control cost 47 percent.

In developing the parallel cost estimates, both the industry and EPA assume the dual absorption process will be used to control sulfur burning plants and many spent acid plants. The more costly Wellman-Power Gas sulfite scrubbing system will be used with plants which process the most contaminated spent acid feedstocks where capital investment historically is 80 percent greater than sulfur burning plants. The Wellman-Power Gas process would also be used for retrofitting existing plants where appropriate. Both the dual absorption and Wellman-Power Gas processes have been demonstrated on commercial installations. Seventy-six dual absorption plants have been constructed or designed since the first in 1964. Only three, however, are located in this country. One sulfite scrubbing process is now in operation in the United States and four more will be put into service in 1972. All are retrofit installations. Two other such scrubbers are being operated in Japan. These seven installations consist of three acid plants, two claus sulfur recovery plants, an oil-fired boiler, and a kraft pulp mill boiler.

Control costs. EPA engineers have reviewed the industry analysis and find no reason to change their original cost estimate. As summarized in Table III, EPA estimates that the cost of achieving the standard is $1.07 to $1.32 per ton of acid for dual absorption systems and $3.50 per ton for sulfite scrubbing systems. The industry estimate for a sulfur burning dual absorption plant is $2.31 greater than EPA's. We believe the industry's estimate to be excessive for the following reasons.

TABLE III

ESTIMATED COSTS OF CONTROLLING SULFUR DIOXIDE FROM CONTACT SULFURIC ACID PLANTS

	Dual absorption process		Sodium sulfite scrubbing	
	Industry	EPA	Industry	EPA
Sulfur burning plants:				
Direct Investment (Thousands of $)	2,000	550	Not anticipated for new sulfur burning plants.	
Total Added Cost ($/Ton)a)	2.38	1.07		
Spent acid plants:				
Direct Investment (Thousands of $)	3,100	900	2,200	2,300
Total Added Cost ($/Ton)a)	4.45	1.22	4.11	2.50

a) Total added cost includes depreciation, taxes, 18% return on investment after taxes and other allocated costs.

Seventy-two percent of the difference between the Du Pont and EPA estimates is due to direct investment, plant overhead, and operating costs for auxiliary process and storage equipment which Du Pont predicts will be necessary to satisfy the standards. EPA does not believe that such auxiliary equipment will be necessary in practice to meet the standard.

Twenty percent of the difference is due to differences in estimates of the cost and consumption of utilities. Elimination of auxiliary equipment referred to above reduces the consumption rate of both electricity and steam. Eight percent results from the industry's apportionment of "other allocated costs" (Corporate Administration, i.e., sales, research, and development, main office, etc.) in proportion to their estimate of the additional investment required for control. Although an accepted procedure for internal cost accounting, this does not represent a true out-of-pocket cost.

In sum, the EPA analysis shows that meeting the proposed standard with a dual absorption plant requires a substantial investment over an uncontrolled plant but only 30 percent as great as indicated by the industry. Moreover, relaxation of the proposed standard by 60 percent (to the level recommended by the industry) would decrease the cost of control in dual absorption plants only 10 to 15 percent. For sulfur burning plants the cost differential would be $0.10 per ton of acid. For spent acid plants, it would be $0.17.

Economic impact of proposed standard. Most sulfuric acid production is captive to large vertically integrated chemical, petroleum, or fertilizer manufacturers. An increasing volume of production also results from the recovery of sulfur dioxide from stack gases or the regeneration of spent acid instead of its discharge into streams.

Depending on the abatement process selected and the plant size, the direct investment for control can range from 14 to 38 percent of the investment in an uncontrolled acid plant.

The added cost of air pollution control, coupled with the inherent market disadvantage of the small manufacturer, may make future construction of plants of less than 500 tons per day economically unattractive except as a sulfur recovery system for another manufacturing process.

It is estimated that the average market price will increase by $1.07 per ton reflecting the lower end of the cost range. This represents a small increase in the $31 per ton market price and will have little effect on the demand for acid.

The increasing production of recovered and regenerated acid, as a result of abatement efforts, will inhibit the growth of conventional acid production and threaten eventually to displace much of that production.

WILLIAM D. RUCKELSHAUS,
Administrator.

MARCH 16, 1972.

[FR Doc.72-4238 Filed 3-20-72;8:51 am]

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Title 40—PROTECTION OF ENVIRONMENT

Chapter I—Environmental Protection Agency

SUBCHAPTER C—AIR PROGRAMS

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Standard for Sulfur Dioxide; Correction

The new source performance standard published December 23, 1971 (36 F.R. 24876), which is applicable to sulfur dioxide emissions from fossil-fuel fired steam generators, incorrectly omits provision for compliance by burning natural gas in combination with oil or coal. Accordingly, in § 60.43 of Title 40 of the Code of Federal Regulations, paragraph (c) is revised and a new paragraph (d) is added, as follows:

§ 60.43 Standard for sulfur dioxide.

* * * * *

(c) Where different fossil fuels are burned simultaneously in any combination, the applicable standard shall be determined by proration using the following formula:

$$\frac{y(0.80) + z\ (1.2)}{y + z}$$

where:
y is the percent of total heat input derived from liquid fossil fuel and,
z is the percent of total heat input derived from solid fossil fuel.

(d) Compliance shall be based on the total heat input from all fossil fuels burned, including gaseous fuels.

This amendment shall be effective upon publication in the FEDERAL REGISTER (7-25-72).

Dated: July 19, 1972.

JOHN QUARLES, Jr.,
Acting Administrator.

[FR Doc.72-11381 Filed 7-25-72;8:49 am]

3 SUBCHAPTER C—AIR PROGRAMS

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Amendment to Standards for Opacity and Corrections to Certain Test Methods

On December 23, 1971, pursuant to section 111 of the Clean Air Act, as amended, 40 CFR part 60 was adopted establishing regulations for the control of air pollution from new cement plants, sulfuric acid plants, nitric acid plants, municipal incinerators, and fossil-fuel-fired steam generators. The standards included opacity limits for visible air pollution emissions; 40 CFR 60 is being amended to clarify the application of opacity standards. The revisions do not alter the stringency of the regulation.

It was EPA's intention that condensed water not be considered a visible air contaminant for purposes of new source performance standards. Condensed water was specifically exempted from the opacity limits promulgated for steam generators and cement plants. Nitric acid plants and sulfuric acid plants were not exempted since there is normally little water vapor in stack gases from these sources. However, under certain weather conditions, scrubbers will generate a visible plume of condensed water. Therefore, in order to clarify enforcement procedures, provisions are being added to exempt condensed water from opacity limits for sulfuric acid plants and for nitric acid plants.

The appendix to part 60 incorrectly presents certain data and equations. These typing/printing errors are being corrected.

This amendment makes certain clarifications and corrections but does not change the substance of the regulation. Therefore, the Administrator has determined that it is unnecessary to publish a notice of proposed rulemaking or delay the effective date of this amendment and for this good cause has not done so.

This amendment shall be effective May 23, 1973.

Dated May 16, 1973.

ROBERT W. FRI,
Acting Administrator.

Part 60, chapter I, title 40, Code of Federal Regulations, is amended as follows:

1. In § 60.72, a new paragraph (c) is added as follows:

§ 60.72 Standards for nitrogen oxides.

* * * * *

(c) Where the presence of uncombined water is the only reason for failure to meet the requirements of paragraph (b) of this section, such failures shall not be considered a violation of this section.

2. In § 60.83, a new paragraph (c) is added as follows:

§ 60.83 Standards for acid mist.

* * * * *

(c) Where the presence of uncombined water is the only reason for failure to meet the requirement of paragraph (b) of this section, such failure shall not be considered a violation of this section.

3. Table 1-1 in method 1 of the appendix to part 60 is revised to read as follows:

4. Equations 5-2 and 5-6 in method 5 of the appendix are revised to read as follows:

Table 1-1. Location of traverse points in circular stacks
(Percent of stack diameter from inside wall to traverse point).

Traverse point number on a diameter	Number of traverse points on a diameter											
	2	4	6	8	10	12	14	16	18	20	22	24
1	14.6	6.7	4.4	3.3	2.5	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	85.4	25.0	14.7	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3		75.0	29.5	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4		93.3	70.5	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5			85.3	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6			95.6	80.6	65.8	35.5	26.9	22.0	18.8	16.5	14.6	13.2
7				89.5	77.4	64.5	36.6	28.3	23.6	20.4	18.0	16.1
8				96.7	85.4	75.0	63.4	37.5	29.6	25.0	21.8	19.4
9					91.8	82.3	73.1	62.5	38.2	30.6	26.1	23.0
10					97.5	88.2	79.9	71.7	61.8	38.8	31.5	27.2
11						93.3	85.4	78.0	70.4	61.2	39.3	32.3
12						97.9	90.1	83.1	76.4	69.4	60.7	39.8
13							94.3	87.5	81.2	75.0	68.5	60.2
14							98.2	91.5	85.4	79.6	73.9	67.7
15								95.1	89.1	83.5	78.2	72.8
16								98.4	92.5	87.1	82.0	77.0
17									95.6	90.3	85.4	80.6
18									98.6	93.3	88.4	83.9
19										96.1	91.3	86.8
20										98.7	94.0	89.5
21											96.5	92.1
22											98.9	94.5
23												96.8
24												98.9

$$V_{w_{std}} = V_{l_c} \frac{\rho H_2O}{M_{H_2O}} \frac{RT_{std}}{P_{std}} \frac{\text{lb.}}{454\ \text{gm.}}$$

$$= 0.0474 \frac{\text{cu. ft.}}{\text{ml.}} V_{l_c}$$

equation 5-2

* * * * * *

$$I = \frac{T_s\left[\left(\frac{0.00267\ \text{in. Hg-cu. ft.}}{\text{ml}-{}^\circ\text{R}}\right)V_{l_c} + \frac{V_m}{T_m}\left(P_{bar} + \frac{H}{13.6}\right)\right]\left(1.667\frac{\text{min.}}{\text{sec.}}\right)}{\theta V_s P_s A_n}$$

equation 5-6

[FR Doc.73-10061 Filed 5-22-73;8:45 am]

4

Title 40—Protection of Environment

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

SUBCHAPTER C—AIR PROGRAMS

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Emissions During Startup, Shutdown, and Malfunction

The Environmental Protection Agency promulgated Standards of Performance for New Stationary Sources pursuant to section 111 of the Clean Air Act Amendments of 1970, 40 U.S.C. 1857c–6, on December 23, 1971, for fossil fuel-fired steam generators, incinerators, Portland cement plants, and nitric and sulfuric acid plants (36 F.R. 24876), and proposed Standards of Performance on June 11, 1973, for asphalt concrete plants, petroleum refineries, storage vessels for petroleum liquids, secondary lead smelters, secondary brass and bronze ingot production plants, iron and steel plants, and sewage treatment plants (38 FR 15406). New or modified sources in these categories are required to meet standards for emissions of air pollutants which reflect the degree of emissions limitation achievable through the application of the best system of emission reduction which (taking into account the cost of achieving such reduction) the Administrator determines has been adequately demonstrated.

Sources which ordinarily comply with the standards may during periods of startup, shutdown, or malfunction unavoidably release pollutants in excess of the standards. These regulations make it clear that compliance with emission standards, other than opacity standards, is determined through performance tests conducted under representative conditions. It is anticipated that the initial performance test and subsequent performance tests will ensure that equipment is installed which will permit the standards to be attained and that such equipment is not allowed to deteriorate to the point where the standards are no longer maintained. In addition, these regulations require that the plant operator use maintenance and operating procedures designed to minimize emissions. This requirement will ensure that plant operators properly maintain and operate the affected facility and control equipment between performance tests and during periods of startup, shutdown, and unavoidable malfunction.

The Environmental Protection Agency on August 25, 1972, proposed procedures pursuant to which new sources could be deemed not to be in violation of the new source performance standards if emissions during startup, shutdown, and malfunction unavoidably exceed the standards (37 FR 17214). Comments received were strongly critical of the reporting requirements and the lack of criteria for determining when a malfunction occurs.

In response to these comments, the Environmental Protection Agency rescinded the August 25, 1972, proposal and published a new proposal on May 2, 1973 (38 FR 17214). The purpose and reasoning in support of the May 2, 1973, proposal are set forth in the preamble to the proposal. As these regulations being promulgated are in substance the same as those of the May 2, 1973, proposal, this preamble will discuss only the comments received in response to the proposal and changes made to the proposal. *

A total of 28 responses were received concerning the proposal (38 FR 10820). Twenty-one responses were received from the industrial sector, three from State and local air pollution control agencies, and four from EPA representatives.

Some air pollution control agencies expressed a preference for more detailed reporting and for requiring reporting immediately following malfunctions and preceding startups and shutdowns in order to facilitate handling citizens' complaints and emergency situations. Since States already have authority to require such reporting and since promulgation of these reporting requirements does not preclude any State from requiring more detailed or more frequent reporting, no changes were deemed necessary.

Some comments indicated that changes were needed to more specifically define those periods of emissions that must be reported on a quarterly basis. The regulations have been revised to respond to this comment. Those periods which must be reported are defined in applicable subparts. Continuous monitoring measurements will be used for determining those emissions which must be reported. Periods of excess emissions will be averaged over specified time periods in accordance with appropriate subparts. Automatic recorders are currently available that produce records on magnetic tapes that can be processed by a central computing system for the purpose of arriving at the necessary averages. By this method and by deletion of requirements for making emission estimates, only minimal time will be required by plant operators in preparing quarterly reports. The time period for making quarterly reports has been extended to 30 days beyond the end of the quarter to allow sufficient time for preparing necessary reports.

The May 2, 1973, proposal required that affected facilities be operated and maintained "in a manner consistent with operations during the most recent performance test indicating compliance." Comments were received questioning whether it would be possible or wise to require that all of the operating conditions that happened to exist during the most recent performance test be continually maintained. In response to these comments, EPA revised this requirement to provide that affected facilities shall be operated and maintained "in a manner consistent with good air pollution control practice for minimizing emissions" (§ 60.11(d)).

Comments were received indicating concern that the proposed regulations would grant license to sources to continue operating after malfunctions are detected. The provision of § 60.11(d) requires that good operating and maintenance practices be followed and thereby precludes continued operation in a malfunctioning condition.

This regulation is promulgated pursuant to sections 111 and 114 of the Clean Air Act as amended (42 U.S.C. 1857c–6, 1857c–9).

This amendment is effective November 14, 1973.

Dated October 10, 1973.

JOHN QUARLES,
Acting Administrator.

Part 60 of Title 40, Code of Federal Regulations is amended as follows:

1. Section 60.2 is amended by adding paragraphs (p), (q), and (r) as follows:

§ 60.2 Definitions.

* * * * *

(p) "Shutdown" means the cessation of operation of an affected facility for any purpose.

(q) "Malfunction" means any sudden and unavoidable failure of air pollution control equipment or process equipment or of a process to operate in a normal or usual manner. Failures that are caused entirely or in part by poor maintenance, careless operation, or any other preventable upset condition or preventable equipment breakdown shall not be considered malfunctions.

(r) "Hourly period" means any 60 minute period commencing on the hour.

2. Section 60.7 is amended by adding paragraph (c) as follows:

§ 60.7 Notification and recordkeeping.

* * * * *

(c) A written report of excess emissions as defined in applicable subparts shall be submitted to the Administrator by each owner or operator for each calendar quarter. The report shall include the magnitude of excess emissions as measured by the required monitoring equipment reduced to the units of the applicable standard, the date, and time of commencement and completion of each period of excess emissions. Periods of excess emissions due to startup, shutdown, and malfunction shall be specifically identified. The nature and cause of any malfunction (if known), the corrective action taken, or preventive measures adopted shall be reported. Each quarterly report is due by the 30th day following the end of the calendar quarter. Reports are not required for any quarter unless there have been periods of excess emissions.

3. Section 60.8 is amended by revising paragraph (c) to read as follows:

§ 60.8 Performance tests.

* * * * *

(c) Performance tests shall be conducted under such conditions as the Administrator shall specify to the plant operator based on representative performance of the affected facility. The owner or operator shall make available to the Administrator such records as may be necessary to determine the conditions of the performance tests. Operations during periods of startup, shutdown, and malfunction shall not constitute representative conditions of performance tests unless otherwise specified in the applicable standard.

4. A new § 60.11 is added as follows:

§ 60.11 Compliance with standards and maintenance requirements.

(a) Compliance with standards in this part, other than opacity standards, shall be determined only by performance tests established by § 60.8.

*May 2, 1973 Preamble immediately follows these revisions.

(b) Compliance with opacity standards in this part shall be determined by use of Test Method 9 of the appendix.

(c) The opacity standards set forth in this part shall apply at all times except during periods of startup, shutdown, malfunction, and as otherwise provided in the applicable standard.

(d) At all times, including periods of startup, shutdown, and malfunction, owners and operators shall, to the extent practicable, maintain and operate any affected facility including associated air pollution control equipment in a manner consistent with good air pollution control practice for minimizing emissions. Determination of whether acceptable operating and maintenance procedures are being used will be based on information available to the Administrator which may include, but is not limited to, monitoring results, opacity observations, review of operating and maintenance procedures, and inspection of the source.

5. A new paragraph is added to § 60.45 as follows:

§ 60.45 Emission and fuel monitoring.

* * * * *

(g) For the purpose of reports required pursuant to § 60.7(c), periods of excess emissions that shall be reported are defined as follows:

(1) Opacity. All hourly periods during which there are three or more one-minute periods when the average opacity exceeds 20 percent.

(2) Sulfur dioxide. Any two consecutive hourly periods during which average sulfur dioxide emissions exceed 0.80 pound per million B.t.u. heat input for liquid fossil fuel burning equipment or exceed 1.2 pound per million B.t.u. heat input for solid fossil fuel burning equipment; or for sources which elect to conduct representatives analyses of fuels in accordance with paragraph (c) or (d) of this section in lieu of installing and operating a monitoring device pursuant to paragraph (a)(2) of this section, any calendar day during which fuel analysis shows that the limits of § 60.43 are exceeded.

(3) Nitrogen oxides. Any two consecutive hourly periods during which the average nitrogen oxides emissions exceed 0.20 pound per million B.t.u. heat input for gaseous fossil fuel burning equipment, or exceed 0.30 pound per million B.t.u. for liquid fossil fuel burning equipment, or exceed 0.70 pound per million B.t.u. heat input for solid fossil fuel burning equipment.

6. A new paragraph is added to § 60.73 as follows:

§ 60.73 Emission monitoring.

* * * * *

(e) For the purpose of making written reports pursuant to § 60.7(c), periods of excess emissions that shall be reported are defined as any two consecutive hourly periods during which average nitrogen oxides emissions exceed 3 pounds per ton of acid produced.

7. A new paragraph is added to § 60.84 as follows:

§ 60.84 Emission monitoring.

* * * * *

(e) For the purpose of making written reports pursuant to § 60.7(c), periods of excess emissions that shall be reported are defined as any two consecutive hourly periods during which average sulfur dioxide emissions exceed 4 pounds per ton of acid produced.

[FR Doc.73-21686 Filed 10-12-73;8:45 am]

4A

ENVIRONMENTAL PROTECTION AGENCY

[40 CFR Part 60]

STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Emissions During Startup, Shutdown and Malfunction

The Environmental Protection Agency promulgated standards of performance for new stationary sources pursuant to section 111 of the Clean Air Amendments of 1970, 40 U.S.C. 1857c-6, on December 23, 1971, for fossil fuel-fired steam generators, incinerators, portland cement plants, and nitric and sulfuric acid plants (36 FR 24876). New or modified sources in those categories are required to meet standards for emissions of air pollutants which reflect the degree of emissions limitation achievable through the application of the best system of emission reduction which (taking into account the cost of achieving such reduction) the Administrator determined to be adequately demonstrated.

On August 25, 1972, the Environmental Protection Agency proposed procedures pursuant to which new sources could be deemed not to be in violation of the new source performance standards if emissions during startup, shutdown and malfunction unavoidably exceeded the standards (37 FR 17214). A total of 141 responses were received during the period allowed for official comment on the proposal. Comments received were strongly critical of the various reporting requirements, and the lack of more specific criteria for granting exceptions to the standards. A number of comments were directed toward EPA's policy on delegating enforcement of these procedures to the States as provided under section 111 of the Clean Air Act. This new proposal is intended to respond to these criticisms. The August 25, 1972, proposal is hereby withdrawn.

Attempts to classify all of the situations in which excess emissions due to malfunction, startup and shutdown could occur and the amount and duration of excess emission from each such situation indicated that it is not feasible to provide quantitative standards or guides which would apply to periods of malfunctions, startups and shutdowns.

Comments received in response to the proposal, however, strongly emphasized the difficulties in planning and financing new sources when no assurance could be made that the sources would be in compliance with the standards or would be granted a waiver in those cases where failure to meet the standard was not the fault of the plant owner or operator. Accordingly, the approach described below is now proposed by EPA. This approach will ensure that new sources install the best adequately demonstrated technology and operate and maintain such equipment to keep emissions as low as possible.

The proposed regulations make it clear that compliance with emission standards, other than opacity standards, is determined through performance tests conducted under representative conditions. The present tests for new sources require that initial performance tests be conducted within 60 days after achieving the maximum production rate at which a facility will be operated but not later than 180 days after startup and authorizes subsequent tests from time to time as required by the Administrator. It is anticipated that the initial performance test and subsequent performance tests will ensure that equipment is installed which will permit the standards to be attained and that such equipment is not allowed to deteriorate to the point where the standards are no longer maintained. In addition, the proposed regulation requires that the plant operator use maintenance and operating procedures designed to minimize emissions in excess of the standard. This requirement will ensure that plant operators properly maintain and operate the affected facility and control equipment between performance tests and during periods of startup, shutdown and unavoidable malfunction.

Although the requirements in the present regulations for continuous monitoring will be unaffected by these proposed regulations, it is made clear that measurements obtained as the results of such monitoring will be used as evidence in determining whether good maintenance and operating procedures are being followed. They will not be used to determine compliance with mass emission standards unless approved as equivalent or alternative method for performance testing. EPA may in the future require that compliance with new source emissions standards be determined by continuous monitoring. In such cases, the applicable standard will specifically require that compliance with mass emission limits be determined by continuous monitoring. Such standards will provide for malfunction, startup and shutdown situations to the extent necessary.

With respect to the opacity standards, a different approach was used because this is a primary means of enforcement using visual surveillance employed by State and Federal officials. EPA believes that the burden should remain on the plant operator to justify a failure to comply with opacity standards. This difference is justified because determination of mass emission levels requires close contact with plant personnel, operations and records and the burden imposed on enforcement agencies to determine whether good maintenance and operating procedures have been followed is not significantly greater than the burden of determining mass emission levels. However, opacity observations are taken outside the plant and do not require contact with plant personnel, operations or records, and the burden of determining whether good maintenance and operating procedures have been followed would be much greater than determining whether opacity standards have been violated. Nevertheless, EPA has recognized that malfunctions, startups and shutdowns may result in the opacity emission levels being exceeded. Accordingly, the standards will not apply in such cases. However, the burden will be upon the plant operator rather than EPA or the States to show that the opacity standards were not met because of such situations. In the event of any dispute, the owner or operator of the source may seek review in an appropriate court.

The reporting requirements in these proposed regulations have been greatly simplified. They require only that at the end of each calendar quarter owners and operators report emissions measured or estimated to be greater than those allowable under standards applicable during performance tests.

EPA believes that the proposed reporting requirements along with application of the opacity standards will provide adequate information to enable EPA and the States to effectively enforce the new source performance standards. Additional information and shorter reporting times would not materally increase enforcement capability and could, in fact, hinder such efforts due to the additional time and manpower required to process the information.

The primary purpose of the quarterly report is to provide EPA and the States with sufficient information to determine if further inspection or performance tests are warranted. It should be noted that the Administrator can delegate enforcement of the standards to the States as provided by section 111(c)(1) of the Clean Air Act, as amended. Procedures for States to request this delegation are available from EPA regional offices. It is EPA's policy that upon delegation any reports required by these proposed regulations will be sent to the appropriate State. (A change in the address for submittal of reports as provided in 40 CFR 60.4 will be made after each delegation.)

These proposed regulations will have no significant adverse impact on the public health and welfare. Those sections of the Clean Air Act which are specifically required to protect the public health and welfare, sections 109 and 110 (National Ambient Air Quality Standards and their implementation), section 112 (National Emission Standards for Hazardous Air Pollutants), and section 303 (Emergency Powers to Stop the Emissions of Air Pollutants Presenting an Imminent and Substantial Endangerment to the Health of Persons), will be unaffected by these new proposed regulations and will continue to be effective controls protecting the public health and welfare.

Interested persons may participate in this proposed rulemaking by submitting written comment in triplicate to the Emission Standards and Engineering Division, Environmental Protection Agency, Research Triangle Park, N.C. 27711, Attention: Mr. Don R. Goodwin. All relevant comments received not later than June 18, 1973, will be considered. Receipt of comments will be acknowledged but the Emission Standards and Engineering Division will not provide substantial response to individual comments. Comments received will be available for public inspection during normal business hours at the Office of Public Affairs, 401 M Street SW., Washington, D.C. 20460.

This notice of proposed rulemaking is issued under the authority of sections 111 and 114 of the Clean Air Act, as amended (42 U.S.C. 1857c–6, 1857c–9).

Dated April 27, 1973.

JOHN QUARLES,
Acting Administrator,
Environmental Protection Agency.

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Title 40—Protection of Environment

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

SUBCHAPTER C—AIR PROGRAMS

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Additions and Miscellaneous Amendments

On June 11, 1973 (38 FR 15406), pursuant to section 111 of the Clean Air Act, as amended, the Administrator proposed standards of performance for new and modified stationary sources within seven categories of stationary sources: (1) Asphalt concrete plants, (2) petroleum refineries, (3) storage vessels for petroleum liquids, (4) secondary lead smelters, (5) secondary brass and bronze ingot production plants, (6) iron and steel plants, and (7) sewage treatment plants. In the same publication, the Administrator also proposed amendments to subpart A, General Provisions, and to the Appendix, Test Methods, of 40 CFR Part 60.

Interested parties participated in the rulemaking by sending comments to EPA. Some 253 letters, many with multiple comments, were received from commentators, and about 152 were received from Congressmen making inquiries on behalf of their constituents. Copies of the comments received directly are available from public inspection at the EPA Office of Public Affairs, 401 M Street SW., Washington, D.C. 20460. The comments have been considered, additional data have been collected and assessed, and the standards have been reevaluated. Where determined by the Administrator to be appropriate, revisions have been made to the proposed standards. The promulgated standards, the principal revisions to the proposed standards, and the Agency's responses to major comments are summarized below. More detail may be found in *Background Information for New Source Performance Standards: Asphalt Concrete Plants, Petroleum Refineries, Storage Vessels, Secondary Lead Smelters and Refineries, Brass and Bronze Ingot Production Plants, Iron and Steel Plants, and Sewage Treatment Plants*, Volume 3, *Promulgated Standards*, (APTD-1352c) which is available on request from the Emission Standards and Engineering Division, Research Triangle Park, North Carolina 27711, Attention: Mr. Don R. Goodwin.

Discussions of the environmental impact of these standards of performance for new sources are contained in Volume 1, Main Text (APTD-1352a), of the background document. This volume and Volume 2, *Appendix: Summaries of Test Data* (APTD-1352b), are still available on request from the office noted above.

In accordance with section 111 of the Act, these regulations prescribing standards of performance for the selected stationary sources are effective on February 28, 1974 and apply to sources the construction or modification of which was commenced after June 11, 1973.

GENERAL PROVISIONS

These promulgated regulations include changes to subpart A, General Provisions, which applies to all new sources. The general provisions were published on December 23, 1971 (36 FR 24876). The definition of "commenced" has been altered to exclude the act of entering into a binding agreement to construct or modify a source from among the specified acts which, if taken by an owner or operator of a source on or after the date on which an applicable new source performance standard is proposed, cause the source to be subject to the promulgated standard. The phrase "binding agreement" was duplicate terminology for the phrase "contractual obligation" but was being construed incorrectly to apply to other arrangements. Deletion of the first phrase and retention of the second phrase eliminates the problem. The definition of "standard conditions" replaces the definition of "standard or normal conditions" to avoid the confusion, noted by commentators, created by the duplicate terminology. The promulgated definition also expresses the temperature and pressure in commonly used metric units to be consistent with the Administrator's policy of converting to the metric system. Four definitions are added: "Reference method," "equivalent method," "alternative method," and "run," to clarify the terms used in changes to § 60.8, Performance Tests, discussed below. The definition of "particulate matter" is added here and removed from each of the subparts specific to this group of new sources to avoid repetition. The word "run," as used in the sections pertinent to performance tests, is defined as the net time required to collect an adequate sample of a pollutant, and may be either intermittent or continuous. Section 60.3, Abbreviations, is revised to include new abbreviations, to accord more closely with standard usage, and to alphabetize the listing. Section 60.4, Address, is revised to change the address to which all requests, reports, applications, submittals, and other communications will be submitted to the Administrator pursuant to any regulatory provision. Such communications are now to be addressed to the Director of the Enforcement Division in the appropriate EPA regional office rather than to the Office of General Enforcement in Washington, D.C. The addresses of all 10 regional offices are included, and the "in triplicate" requirement is changed to "in duplicate." Some of the wording is changed in § 60.6, Review of Plans, to require that owners or operators requesting review of plans for construction or modification make a separate request for each project rather than for each affected facility as previously required; each such facility, however, must be identified and appropriately described. A paragraph is added to § 60.7, Notification and Recordkeeping, to require owners and operators to maintain a file of all recorded information required by the regulations for at least 2 years after the dates of such information, and this requirement is removed from the subparts specific to each of the new sources in this group to avoid repetition. Section 60.8, Performance Tests, is amended (1) to require owners and operators to give the Administrator 30 days' advance notice, instead of 10 days', of performance testing to demonstrate compliance with standards in order to provide the Administrator with a better opportunity to have an observer present, (2) to specify the Administrator's authority to permit, in specific cases, the use of minor changes to reference methods, the use of equivalent or alternative methods, or the waiver of the performance test requirement, and (3) to specify that each performance test shall consist of three runs except where the Administrator approves the use of two runs because of circumstances beyond the control of the owner or operator. These amendments give the Administrator needed flexibility for making judgments for determining compliance with standards. Section 60.12, Circumvention, is added to clearly prohibit owners and operators from using devices or techniques which conceal, rather than control, emissions to comply with standards of performance for new sources. The standards proposed on June 11, 1973, contained provisions which required compliance to be based on undiluted gases. Many commentators pointed out the inequities of these provisions and the vagueness of the language used. Because many processes require the addition of air in various quantities for cooling, for enhancing combustion, and for other useful purposes, no single definition of excess dilution air can be sensibly applied. It is considered preferable to state clearly what is prohibited and to use the Administrator's authority to specify the conditions for compliance testing in each case to ensure that the prohibited concealment is not used.

OPACITY

It is evident from comments received that an inadequate explanation was given for applying both an enforceable opacity standard and an enforceable concentration standard to the same source and that the relationship between the concentration standard and the opacity standard was not clearly presented. Because all but one of the regulations include these dual standards, this subject is dealt with here from the general viewpoint. Specific changes made to the regulations proposed for a specific source are described in the discussions of each source.

A discussion of the major points raised by the comments on the opacity standard follows:

1. Several commentators felt that opacity limits should be only guidelines for determining when to conduct the stack tests needed to determine compliance with concentration/mass standards. Several other commentators expressed the opinion that the opacity standard was more stringent than the concentration/mass standard.

As promulgated below, the opacity standards are regulatory requirements, just like the concentration/mass standards. It is not necessary to show that the concentration/mass standard is being violated in order to support enforcement of the opacity standard. Where opacity and concentration/mass standards are applicable to the same source, the opacity standard is not more restrictive than the concentration/mass standard. The concentration/mass standard is established at a level which will result in the design, installation, and operation of the best adequately demonstrated system of emission reduction (taking costs into account) for each source. The opacity standard is established at a level which will require proper operation and maintenance of such control systems on a day-to-day basis, but not require the design and installation of a control system more efficient or expensive than that required by the concentration/mass standard.

Opacity standards are a necessary supplement to concentration/mass standards. Opacity standards help ensure that sources and emission control systems continue to be properly maintained and operated so as to comply with concentration/mass standards. Particulate testing by EPA method 5 and most other techniques requires an expenditure of $3,000 to $10,000 per test including about 300 man-hours of technical and semitechnical personnel. Furthermore, scheduling and preparation are required such that it is seldom possible to conduct a test with less than 2 weeks notice. Therefore, method 5 particulate tests can be conducted only on an infrequent basis.

If there were no standards other than concentration/mass standards, it would be possible to inadequately operate or maintain pollution control equipment at all times except during periods of performance testing. It takes 2 weeks or longer to schedule a typical stack test. If only small repairs were required, e.g., pump or fan repair or replacement of fabric filter bags, such remedial action could be delayed until shortly before the test is conducted. For some types of equipment such as scrubbers, the energy input could be reduced (the pressure drop through the system) when stack tests weren't being conducted, which would result in the release of significantly more particulate matter than normal. Therefore, EPA has required that operators properly maintain air pollution control equipment at all times (40 CFR 60.11 (d)) and meet opacity standards at all times except during periods of startup, shutdown, and malfunction (40 CFR 60.11(c)), and during other periods of exemption as specified in individual regulations.

Opacity of emissions is indicative of whether control equipment is properly maintained and operated. However, it is established as an independent enforceable standard, rather than an indicator of maintenance and operating conditions because information concerning the latter is peculiarly within the control of the plant operator. Furthermore, the time and expense required to prove that proper procedures have not been followed are so great that the provisions of 40 CFR 60.11(d) by themselves (without opacity standards) would not provide an economically sensible means of ensuring on a day-to-day basis that emissions of pollutants are within allowable limits. Opacity standards require nothing more than a trained observer and can be performed with no prior notice. Normally, it is not even necessary for the observer to be admitted to the plant to determine properly the opacity of stack emissions. Where observed opacities are within allowable limits, it is not normally necessary for enforcement personnel to enter the plant or contact plant personnel. However, in some cases, including times when opacity standards may not be violated, a full investigation of operating and maintenance conditions will be desirable. Accordingly, EPA has requirements for both opacity limits and proper operating and maintenance procedures.

2. Some commentators suggested that the regulatory opacity limits should be lowered to be consistent with the opacity observed at existing plants; others felt that the opacity limits were too stringent. The regulatory opacity limits are sufficiently close to observed opacity to ensure proper operation and maintenance of control systems on a continuing basis but still allow some room for minor variations from the conditions existing at the time opacity readings were made.

3. There are specified periods during which opacity standards do not apply. Commentators questioned the rationale for these time exemptions, as proposed, some pointing out that the exemptions were not justified and some that they were inadequate. Time exemptions further reflect the stated purpose of opacity standards by providing relief from such standards during periods when acceptable systems of emission reduction are judged to be incapable of meeting prescribed opacity limits. Opacity standards do not apply to emissions during periods of startup, shutdown, and malfunction (see FEDERAL REGISTER of October 15, 1973, 38 FR 28564), nor do opacity standards apply during periods judged necessary to permit the observed excess emissions caused by soot-blowing and unstable process conditions. Some confusion resulted from the fact that the startup-shutdown-malfunction regulations were proposed separately (see FEDERAL REGISTER of May 2, 1973, 38 FR 10820) from the regultions for this group of new sources. Although this was pointed out in the preamble (see FEDERAL REGISTER of June 11, 1973, 38 FR 15406) to this group of new source performance standards, it appears to have escaped the notice of several commentators.

4. Other comments, along with restudy of sources and additional opacity observations, have led to definition of specific time exemptions, where needed, to account for excess emissions resulting from soot-blowing and process variations. These specific actions replace the generalized approach to time exemptions, 2 minutes per hour, contained in all but one of the proposed opacity standards. The intent of the 2 minutes was to prevent the opacity standards from being unfairly stringent and reflected an arbitrary selection of a time exemption to serve this purpose. Comments noted that observed opacity and operating conditions did not support this approach. Some pointed out that these exemptions were not warranted; others, that they were inadequate. The cyclical basic oxygen steel-making process, for example, does not operate in hourly cycles and the inappropriateness of 2 minutes per hour in this case would apply to other cyclical processes which exist both in sources now subject to standards of performance and sources for which standards will be developed in the future. The time exemptions now provide for circumstances specific to the sources and, coupled with the startup-shutdown-malfunction provisions and the higher-than-observed opacity limits, provide much better assurance that the opacity standards are not unfairly stringent.

ASPHALT CONCRETE PLANTS

The promulgated standards for asphalt concerete plants limit particulate matter emissions to 90 mg/dscm (0.04 gr/dscf and 20 percent opacity.

The majority of the comments received on the seven proposed standards related to the proposed standards for asphalt concrete plants. Out of the 253 letters, over 65 percent related to the proposed standards for asphalt concrete plants. Each of the comments was reviewed and evaluated. The Agency's responses to the comments received are included in Appendix E of Volume 3 of the background information document. The Agency's rationale for the promulgated standards for asphalt concrete plants is summarized below. A more detailed statement is presented in Volume 3 of the background information document.

The major differences between the proposed standards and the promulgated standards are:

1. The concentration standard has been changed from 70 mg/dscm (0.031 gr/dscf) to 90 mg/dscm (0.04 gr/dscf).
2. The opacity standard has been changed from 10 percent with a 2-minute-per-hour exemption to 20 percent with no specified time exemption.
3. The definition of affected facility has been reworded to better define the applicability of the standards.

The preamble to the proposed standard (38 FR 15406) urged all interested parties to submit factual data during the comment period to ensure that the standard for asphalt concrete plants would, upon promulgation, be consistent with the requirements of section 111 of the Act. A substantial amount of information on emission tests was submitted in response to this request. The information is summarized and discussed in Volume 3 of the background information document.

The proposed concentration standard was based on the conclusion that the best demonstrated systems of emission reduction, considering costs, are well designed, operated, and maintained baghouses or venturi scrubbers. The emission test data available at the time of proposal indicated that such systems could attain an emission level of 70 mg/Nm^3, or 0.031 gr/dscf. After considering comments on the proposed standard and new emission test data, a thorough evalulation was made of the achievability of the proposed standard. As a result of this evaluation, the concentration standard was changed to 90 mg/dscm, or 0.04 gr/dscf.

With the exception of three cases, the acceptable data had shown that the proposed concentration standard, 0.031 gr/dscf, is achievable with a properly designed, installed, operated, and maintained baghouse or venturi scrubber. The three exceptions, two plants equipped with baghouses and one with a venturi scrubber, had emissions between 0.031 and 0.04 gr/dscf.

Some of the major comments received from the industry were (1) the proposed concentration standard of 0.031 gr/dscf cannot be attained either consistently or at all with currently available equipment; (2) the standard should be 0.06 gr/dscf; (3) the standard should allow higher emissions when heavy fuel oil is burned; (4) the type of aggregate used by a plant changes and affects the emissions; (5) EPA failed to consider the impact of the standard on mobile plants, continuous-mix plants, and drum-mixing plants; and (6) the EPA control cost estimates are too low. Responses to these comments and others are given in Appendix E to Volume 3 of the background information document. When considered as a whole, along with the new emission data, the comments justify revising the standard. The revision is merely a change in EPA's judgment about what emission limit is achievable using the best systems of emission reduction. The revision is in no way a change in what EPA considers to be the best systems of emission reduction which, taking into account the cost of achieving such reduction, have been adequately demonstrated; these are still considered to be well designed, operated, and maintained baghouses or venturi scrubbers.

In response to comments received on the proposed opacity standard, additional data were obtained on visible emissions from three well-controlled plants. The data are summarized in Volume 3 of the background information document. No visible emissions were observed from the control equipment on any of the plants. In addition, one plant showed no visible fugitive emissions. Inspection of the two plants having visible fugitive emissions, together with the fact that one plant had no visible emissions, shows that all of the fugitive emissions observed could have been prevented by proper design, operation, and maintenance of the asphalt plant and its control equipment. The data show no normal process variations that would cause visible emissions, either fugitive or from the control device, at a well-controlled plant.

As indicated above in the discussion on opacity, the opacity standards are set such that they are not more restrictive than the applicable concentration standard. In the case of asphalt concrete plants, it is the judgment of the Administrator that if a plant's emissions equal or exceed 20 percent opacity, the emissions will also clearly exceed the concentration standard of 90 mg/dscm (0.04 gr/dscf). Therefore, the promulgated standard of 20 percent opacity is not more restrictive than the concentration standard and no specific time exemptions are considered necessary.

An additional relief from the opacity standard is provided by the regulation promulgated on October 15, 1973 (38 FR 28564), which exempts from opacity standards any emissions generated during startups, shutdowns, or malfunctions. A general discussion of the purpose of opacity standards and the issues involved in setting them is included in Chapter 2, Volume 3, of the background information document.

Section 60.90, applicability and designation of affected facility, is changed from that proposed in order to clarify how and when the standards apply to asphalt concrete plants. The proposed regulation was interpreted by some commentators as requiring existing plants to meet the standards of performance for new sources when equipment was normally replaced or modernized. The proposed regulation specified certain equipment, e.g., transfer and storage systems, as affected facilities, and, because of regulatory language, this could have been interpreted to mean that a new conveyor system installed to replace a worn-out conveyor system on an existing plant was a new source as defined in section 111(a)(2) of the Act. The promulgated regulation specifies the asphalt concrete plant as the affected facility in order to avoid this unwanted interpretation. An existing asphalt concrete plant is subject to the promulgated standards of performance for new sources only if a physical change to the plant or change in the method of operating the plant causes an increase in the amount of air pollutants emitted. Routine maintenance, repair and replacement; relocation of a portable plant; change of aggregate; and transfer of ownership are not considered modifications which would require an existing plant to comply with the standard.

Industry's comments on the cost estimates pertinent to the proposed standards pointed out some errors and oversights. The cost estimates have been revised to include: (1) An increase in the investment cost for baghouses, (2) a change of credit for mineral filler from $9.00 to $3.40 per ton, and (3) an increase in the disposal costs. The changes increased the estimated investment cost of the control equipment by approximately 20 percent. The revised cost estimates are presented in Volume 3 of the background information document. It is concluded after evaluating the revised estimates that a baghouse designed with a 6-to-1 air-to-cloth ratio or a venturi scrubber with a pressure drop of at least 20 inches water gauge can be installed, operated, and maintained at a reasonable cost. It should be noted that the cost estimates were revised because the original estimates contained some errors and oversights, not because the concentration standard was changed

Petroleum Refineries

The promulgated standards for petroleum refineries limit emissions of sulfur dioxide from fuel gas combustion systems and limit emissions of particulate matter and carbon monoxide from fluid catalytic cracking unit catalyst regenerators.

Each of the comments received on the proposed standards was reviewed and evaluated. The Agency's responses to the comments received are included in Appendix E of Volume 3 of the background information document. The Agency's rationale for the promulgated standards for petroleum refineries is summarised below. A more detailed statement is presented in Volume 3 of the background information document.

The major differences between the promulgated standards and the proposed standards are:

1. The combustion of process upset gases in flare systems has been exempted.
2. Hydrogen sulfide in fuel gases combusted in any number of facilities may be monitored at one location if sampling at this location yields results representative of the hydrogen sulfide concentration in the fuel gas combusted in each facility.
3. The opacity standard for catalyst regenerators has been changed from the proposed level of less than 20 percent except for 3 minutes in any 1 hour to less than 30 percent except for 3 minutes in any 1 hour.
4. The standard for particulate matter has been changed from the proposed level of 50 mg/Nm^3 (0.022 gr/dscf) to 1.0 kilogram per 1,000 kilograms of coke burn-off in the catalyst regenerator (0.027 gr/dscf).

The two changes made to the proposed standard for fuel gas combustion systems do not represent any change in the Agency's original intent. It was evident from the comments received, however, that the intent of the regulation was not clear. Therefore, explicit provisions were incorporated into the promulgated standard to exempt the flaring of process upset gases and to permit monitoring at one location of the hydrogen sulfide content of fuel gases combusted in any number of combustion devices. Although hydrogen sulfide monitors are widely used by industry, the Agency has not evaluated the operating characteristics of such instruments. For this reason, calibration and zero specifications have been prescribed in only general terms. On the basis of evaluation programs currently underway, these requirements will be revised, or further guidance will be provided concerning the selection, operation and maintenance of such instruments.

Commentators suggested that small petroleum refineries be exempt from the standard for fuel gas combustion systems since compliance with the standard would impose a severe economic penalty on small refineries. This problem was considered during the development of the proposed standard. It was concluded, however, that the proposed standard would have little or no adverse economic impact on petroleum refineries. In light of the comments received, the Agency reexamined this point with particular attention to the small refiner.

The details of the anlaysis are presented in Appendix C to Volume 3 of the background information document. The domestic petroleum industry is extremely complex and highly sophisticated. Thus, any analysis of the petroleum refining industry will of necessity be based on a number of simplifying assumptions. Although the assumptions in the economic impact statement appear reasonable, the statement should not be viewed as definitively identifying specific costs; rather it identifies a range of costs and approximate impact points. The analysis examines more than the economic impact of the standard for fuel gas combustion systems. It also examines the combined economic impact of this standard for fuel gas combustion systems, the standards for fluid catalytic cracking units, the water quality effluent guidelines being developed for petroleum refineries, and EPA's regulations requiring the reduction of lead in gasoline. Essentially, the economic impact of 'pollution control' is reviewed in light of the petroleum import license-fee program being administered by the Oil and Gas Office of the Department of the Interior (38 FR 9645 and 38 FR 16195).

This program is designed to encourage expansion and construction of U.S. petroleum refining capacity and expansion of U.S. crude oil production by imposing a fee or tariff on imported petroleum products and crude oil. Although this program is currently being phased into practice with the full impact not to be felt until mid-1975, the central feature of the program is to impose a fee of 21c per barrel above world price on imported crude oil and a fee of 63c per barrel above world price on imported petroleum products such as gasoline, fuel oils, and 'unfinished' or intermediate petroleum products.

Under the conditions currently existing in the United States, which are forecast to continue throughout the remainder of this decade and most of the next decade, and with domestic demand for crude oil and petroleum products far outstripping domestic supply and petroleum refining capacity, the import license-fee program will encourage domestic prices of crude oil and petroleum products to increase to world levels plus the fee or tariff. Thus, an incentive of 42¢ per barrel (63¢ per barrel minus 21¢ per barrel) is provided to domestic refiners by this program. In cases where 'independent' refiners continue to enjoy a captive supply of domestic crude oil, or where 'major' refiners engaged in the exploration and production of domestic crude are successful in supplying their refineries with domestic crude oil, this incentive will approach the full 63¢ per barrel fee imposed on imported petroleum products.

The analysis indicates that the incentive provided to the domestic petroleum refining industry by the import license-fee program is greater than the costs of pollution control requirements. The differences in control costs for the small refiner relative to the large refiner will still exist, but with the fee system in operation the small refiner will not be forced into a no-growth situation because of compliance with EPA requirements. Therefore small refineries are not exempt from the standards.

In response to comments received on the proposed opacity standard, additional data were obtained on visible emissions from four well-controlled catalyst regenerators. The data, which are summarized in Volume 3 of the background information document, indicate that 20 percent opacity is too restrictive for a well-controlled plant. As indicated above in the discussion on opacity, it is the Administrator's intent to set opacity standards such that they are not more restrictive than the applicable concentration or mass standard. In the case of catalyst regenerators, it is the judgment of the Administrator that if visible emissions exceed 30 percent opacity except for 3 minutes in any 1 hour, such emissions will also clearly exceed the standard of 1.0 kilogram of particulate matter per 1,000 kilograms of coke burn-off. Therefore, the promulgated standard of 30 percent except for 3 minutes in any 1 hour is judged to be not more restrictive than the mass standard of 1.0 kg/1,000 kg of coke burn-off.

An additional relief from the opacity standard is provided by the regulations promulgated on October 15, 1973 (38 FR 28564), which exempt from opacity standards any emissions generated during startups, shutdowns, or malfunctions. A general discussion of the purpose of opacity standards and the issues involved in setting them is included in Chapter 2 of Volume 3 of the background information document.

Commentators pointed out that the volume of gases discharged to the atmosphere from catalyst regenerators can vary significantly, depending upon the overall system used to control emissions of particulate matter and carbon monoxide. Consequently, the degree of control required to meet the proposed concentration standard (50 mg/Nm^3) for particulate matter depends upon the overall type of emission control system employed.

The various types of emission control systems utilized by catalyst regenerators and the alternative means of expressing an emission standard for particulate matter other than by an allowable concentration of particulate matter were evaluated. The alternative ways of expressing the standard were (1) specification of control efficiency, (2) limiting emissions based on a process weight restriction, and (3) limiting emissions on the basis of the size or capacity of a unit. Expressing the standard in terms of kilograms of particulate matter per 1,000 kilograms of coke burn-off was determined to be the best alternative.

Several of those who wrote to the Agency indicated that the proposed particulate matter standard for catalyst regenerators (50 mg/Nm^3) was too restrictive. To fully evaluate these comments, additional data on emissions from well-controlled units were obtained from industry and a control agency. This new information and the detailed rationale for the promulgated standard are presented in Volume 3 of the background information document.

This evaluation led to the conclusion that the allowable particulate matter emissions should be increased to provide for the unavoidable increase in emissions due to the deterioration of the cyclones within a catalyst regenerator. The revision reflects a change in the Agency's judgment on what emission limit is achievable using the best systems of emission reduction; it is not a change in what the Agency considers to be the best systems of emission reduction that have been adequately demonstrated.

STORAGE VESSELS FOR PETROLEUM LIQUIDS

The promulgated standard applies to storage vessels with capacities greater than 151,412 liters (40,000 gallons) that contain crude petroleum, condensate, or finished or intermediate products of a petroleum refinery. To reduce emissions of hydrocarbons to the atmosphere, a vapor recovery system or equivalent control is required if the stored liquid has a true vapor pressure, under storage conditions, greater than 570 millimeters of mercury (mm Hg); and a floating roof or equivalent control is required if the stored liquid's pressure is between 78 and 570 mm Hg, inclusive. Records must be kept of liquids stored, by date; of typical vapor pressure; and, in certain cases, of average monthly storage temperatures. The Administrator may require, in specific cases, that the liquid be sampled and true vapor pressure determined, but normally the maintenance of good records that are ready for inspection will be the requirement that owners and operators must meet in order to demonstrate compliance.

The definition of "storage vessel" is changed from the proposed form to specifically exclude high-pressure vessels, subsurface caverns, porous-rock reservoirs, and some underground tanks. As commentators pointed out, these types of storage are optimum for preventing the release of emissions to the atmosphere and need no additional control devices. The proposed definition of "petroleum liquids" was validly criticized as being too inclusive, and it is changed to specify what is included and what is excluded. The definition of vapor recovery system expresses the intent, in part, of such a system as "to prevent * * * emission." Some commentators felt that this could imply a requirement for 100 percent effectiveness. The definition is consistent with the wording found in many State and local regulations for storage of petroleum liquids—regulations that have been sensibly enforced and complied with. EPA recognizes that the effectiveness of such systems varies with climate and types and concentrations of vapors and deliberately avoided requiring a specific level of effectiveness. Control systems which are capable of providing an equivalent amount of control of hydrocarbon emissions may be used in lieu of the systems specified by the standard. An example of an equivalent control system is one which incinerates with an auxiliary fuel the hydrocarbon emissions from the storage tank before such emissions are released into the atmosphere.

The storage of crude oil and condensate at producing fields is specifically exempted from the standard. The proposed regulation had intended such an exemption by applying the standard only to storage vessels with capacities above 65,000 gallons. Industry representatives indicated that this action would exempt essentially all of the producing field storage, but later data showed that larger tanks are used in these locations. The specific exemption in the promulgated regulation better suits the intention. The standard now applies at capacities greater than 40,000 gallons, the size originally selected as being most consistent with existing State and local regulations before it was increased to exempt producing field storage. Producing field storage is exempt because the low level of emissions, the relatively small size of these tanks, and their commonly remote locations argue against justifying the switch from the bolted-construction, fixed-roof tanks in common use to the welded-construction, floating-roof tanks that would be required for new sources to comply with the standards.

The proposed standard required the use of conservation vents when petroleum liquids were stored at true vapor pressures less than 78 mm Hg. This requirement is deleted because, as commentators validly argued, certain stocks foul these vents, in cold weather the vents must be locked open or removed to prevent freezing, and the beneficial effects of such vents are minimal.

The monitoring and recordkeeping requirements are substantially reduced from those which were proposed. Over half of those who commented on this regulation argued that an unjustifiable burden was placed on owners and operators of remote tank farms, terminals, and marketing operations. EPA agrees. The basis for the proposed standard was the large, modern refinery which could have met the proposed requirements with little difficulty. The reduced requirements aid both enforcement officials and owners/operators by reducing paperwork without sacrificing the objectives of the regulation.

Some specific maintenance requirements were proposed but are deleted. Commentators pointed out that these requirements were not sufficiently explicit. A recent change to the General Provisions, subpart A, (see Federal Register of October 15, 1973, 38 FR 28564) requires that all affected facilities and emission control systems be operated and maintained in a manner consistent with good air pollution control practice for minimizing emissions. This provision will ensure the use of good maintenance practices for storage vessels, which was the intent of the proposed maintenance requirements.

Secondary Lead Smelters and Refineries

The promulgated standards limit emissions of particulate matter (1) from blast (cupola) and reverberatory furnaces to no more than 50 mg/dscm (0.022 gr/dscf) and to less than 20 percent opacity, and (2) from pot furnaces having charging capacities equal to or greater than 250 kilograms to less than 10 percent opacity.

These standards are the same as those proposed except that the 2-minutes-per-hour exemption is removed from both opacity standards. The general rationale for this change is presented above in the discussion of opacity. Two factors led to this change in the opacity standards: (1) The separately promulgated regulations that provide exemptions from the opacity standards during periods of startup, shutdown, and malfunction (see Federal Register of October 15, 1973, 38 FR 28564), and (2) the comments, reevaluation of data, and collection of new data and information which show that there is no basis for time exemptions in addition to those provided for startups, shutdowns, and malfunctions, and that the opacity standard is not more restrictive than the concentration standard.

Minor changes to the proposed version of the regulation have been made to clarify meanings and to exclude repetitive provisions and definitions which are now included in subpart A, General Provisions, and which are applicable to all new source performance standards.

Secondary Brass and Bronze Ingot Production Plants

The promulgated standards limit the emissions of particulate matter (1) from reverberatory furnaces having production capacities equal to or greater than 1,000 kg (2,205 lb) to no more than 50 mg/dscm (0.022 gr/dscf) and to less than 20 percent opacity, (2) from electric furnaces having capacities equal to or greater than 1,000 kg (2,205 lb) to less than 10 percent opacity, and (3) from blast (cupola) furnaces having capacities equal to or greater than 250 kg/hr (550 lb/hr) to less than 10 percent opacity.

These standards are the same as those proposed except that the opacity limit for emissions from the affected reverberatory furnaces is increased from less than 10 percent to less than 20 percent and the 2-minutes-per-hour exemption is removed from all three opacity standards. The general rationale for these changes is presented in the discussion of opacity above. The three factors which led to these changes are (1) the data and comments, summarized in Volume 3 of the background information document, which show, in the judgment of the Administrator, that the opacity standard proposed for reverberatory furnaces was too restrictive and that the promulgated opacity standard is not more restricted than the concentration standard, (2) the separately promulgated regulations which provide exemptions from opacity standards during periods of startup, shutdown, and malfunction (see Federal Register of October 15, 1973, 38 FR 28564), and (3) the comments, reevaluation of data, and collection of new data and information which show that there is no basis for additional time exemptions.

Minor changes to the proposed version of the regulation have been made to clarify meanings and to exclude repetitive provisions and definitions which are now included in subpart A, General Provisions, and which are applicable to all new source performance standards.

Iron and Steel Plants

The promulgated standards limit the emissions of particulate matter from basic oxygen process furnaces to no more than 50 mg/dscm (0.022 gr/dscf). This is the same concentration limit as was proposed. The opacity standard and the attendant monitoring requirement are not promulgated at this time. Sections of the regulation are reserved for the inclusion of these portions at a later date. Commentators pointed out the inappropriateness of the proposed opacity standard (10 percent opacity except for 2 minutes each hour) for this cyclic steelmaking process. The separate promulgation of regulations which provide exemptions from opacity standards during periods of startup, shutdown, and malfunction (see Federal Register of October 15, 1973, 38 FR 28564) add another dimension to the problem, and new data show variations in opacity for reasons not yet well enough identified.

The promulgated regulation represents no substantial change to that proposed. Some wording is changed to clarify meanings and, as discussed under General Provisions above, several provisions and definitions are deleted from this subpart and added to subpart A, which applies to all new source performance standards, to avoid repetition.

Sewage Treatment Plants

The promulgated standards for sludge incinerators at municipal sewage treatment plants limit particulate emissions to no more than 0.65 g/kg dry sludge input (1.30 lb/ton dry sludge input) and to less than 20 percent opacity. The proposed standards would have limited emissions to a concentration of 70 mg/Nm^3 (0.031 gr/dscf) and to less than 10 percent opacity except for 2 minutes in any 1 hour. The level of control required by the standard remains the same, but the units are changed from a concentration to a mass basis because the determination of combustion air as opposed to dilution air for these facilities is particularly difficult and could lead to unacceptable degrees of error. The section on test methods is revised in accordance with the change of units for the standard.

A section is added specifying instrumentation and sampling access points needed to determine sludge charging rate. Determination of this rate is necessary as a result of the change of units for the standard. Flow measuring devices with an accuracy of ±5 percent must be installed to determine either the mass or volume of the sludge charged to the incinerator, and access to the sludge charged must be provided so a well-mixed representative grab sample of the sludge can be obtained.

The general rationale for the change in the opacity standard is presented in the discussion of opacity above. The three factors which led to this change are (1) the data, summarized in Volume 3 of the background information document, which, in the judgment of the Administrator, show that the proposed opacity standard was too restrictive and that the promulgated standard is not more restrictive than the mass standard, (2) the separately promulgated regulations which provide exemptions from opacity standards during periods of startup, shutdown, and malfunction (see FEDERAL REGISTER of October 15, 1973, 38 FR 28564), and (3) reevaluation of data and collection of new data and information which show that there is no basis for additional time exemptions.

Minor changes to the proposed version of the regulation have been made to clarify meanings and to exclude repetitive provisions and definitions which are now included in subpart A, General Provisions, and are applicable to all new source performance standards.

TEST METHODS

Test Methods 10 and 11 as proposed contained typographical errors that are now corrected in both text and equations. Some wording is changed to clarify meanings and procedures as well.

In Method 10, which is for determination of CO emissions, the term "grab sampling" is changed to "continuous sampling" to prevent confusion. The Orsat analyzer is deleted from the list of analytical equipment because a less complex method of analysis was judged sufficiently sensitive. For clarification, a sentence is added to the section on reagents requiring calibration gases to be certified by the manufacturer. Temperature of the silica gel is changed from 177°C (350°F) to 175°C (347°F) to be consistent with the emphasis on metric units as the primary units. A technique for determining the CO_2 content of the gas has been added to both the continuous and integrated sampling procedures. This technique may be used rather than the technique described in Method 3. Use of the latter technique was required in the proposed Method 10.

Method 11, which is for determination of H_2S emissions, is modified to require five midget impingers rather than the proposed four. The fifth impinger contains hydrogen peroxide to remove sulfur dioxide as an interferant. A paragraph is added specifying the hydrogen peroxide solution to be used, and the procedure description is altered to include procedures specific to the fifth impinger. The term "iodine number flask" is changed to "iodine flask" to prevent confusion.

Dated: February 22, 1974.

RUSSELL E. TRAIN,
Administrator.

Part 60, Chapter I, Title 40, Code of Federal Regulations, is amended by revising subpart A, by adding new subparts I,J,K,L,M,N, and O, and by adding Methods 10 and 11 to the Appendix, as follows:

Subpart A—General Provisions

Sec.
60.2 Definitions.
60.3 Abbreviations.
60.4 Address.
60.6 Review of plans.
60.7 Notification and recordkeeping.
60.8 Performance tests.
60.12 Circumvention.

Subpart I—Standards of Performance for Asphalt Concrete Plants

60.90 Applicability and designation of affected facility.
60.91 Definitions.
60.92 Standard for particulate matter.
60.93 Test methods and procedures.

Subpart J—Standards of Performance for Petroleum Refineries

60.100 Applicability and designation of affected facility.
60.101 Definitions.
60.102 Standard for particulate matter.
60.103 Standard for carbon monoxide.
60.104 Standard for sulfur dioxide.
60.105 Emission monitoring.
60.106 Test methods and procedures.

Subpart K—Standards of Performance for Storage Vessels for Petroleum Liquids

60.110 Applicability and designation of affected facility.
60.111 Definitions.
60.112 Standard for hydrocarbons.
60.113 Monitoring of operations.

Subpart L—Standards of Performance for Secondary Lead Smelters

60.120 Applicability and designation of affected facility.
60.121 Definitions.
60.122 Standard for particulate matter.
60.123 Test methods and procedures.

Subpart M—Standards of Performance for Secondary Brass and Bronze Ingot Production Plants

60.130 Applicability and designation of affected facility.
60.131 Definitions.
60.132 Standard for particulate matter.
60.133 Test methods and procedures.

Subpart N—Standards of Performance for Iron and Steel Plants

60.140 Applicability and designation of affected facility.
60.141 Definitions.
60.142 Standard for particulate matter.
60.143 [Reserved]
60.144 Test methods and procedures.

Subpart O—Standards of Performance for Sewage Treatment Plants

60.150 Applicability and designation of affected facility.
60.151 Definitions.
60.152 Standard for particulate matter.
60.153 Monitoring of operations.
60.154 Test methods and procedures.

APPENDIX—TEST METHODS

Method 10—Determination of carbon monoxide emissions from stationary sources.
Method 11—Determination of hydrogen sulfide emissions from stationary sources.

AUTHORITY: Secs. 111, 114, Pub. L. 91-604 (42 U.S.C. 1857(c)(6) and (9)).

Subpart A—General Provisions

1. Section 60.2 is amended by revising paragraphs (i) and (1) and adding paragraphs (s), (t), (u), (v), and (w) as follows:

§ 60.2 Definitions.

* * * * *

(i) "Commenced" means, with respect to the definition of "new source" in section 111(a)(2) of the Act, that an owner or operator has undertaken a continuous program of construction or modification or that an owner or operator has entered into a contractual obligation to undertake and complete, within a reasonable time, a continuous program of construction or modification.

* * * * *

(1) "Standard conditions" means a temperature of 20°C (68°F) and a pressure of 760 mm of Hg (29.92 in. of Hg).

* * * * *

(s) "Reference method" means any method of sampling and analyzing for an air pollutant as described in the appendix to this part.

(t) "Equivalent method" means any method of sampling and analyzing for an air pollutant which have been demonstrated to the Administartor's satisfaction to have a consistent and quantitatively known relationship to the reference method, under specified conditions.

(u) "Alternative method" means any method of sampling and analyzing for an air pollutant which is not a reference or equivalent method but which has been demonstrated to the Administrator's satisfaction to, in specific cases, produce results adequate for his determination of compliance.

(v) "Particulate matter" means any finely divided solid or liquid material, other than uncombined water, as measured by method 5 of the appendix.

(w) "Run" means the net period of time during which an emission sample is collected. Unless otherwise specified, a run may be either intermittent or continuous within the limits of good engineering practice.

2. Section 60.3 is revised to read as follows:

§ 60.3 Abbreviations.

The abbreviations used in this part have the following meanings:

A.S.T.M.—American Society for Testing and Materials
Btu—British thermal unit
°C—degree Celsius (centigrade)
cal—calorie
CdS—cadmium sulfide
cfm—cubic feet per minute
CO—carbon monoxide
CO_2—carbon dioxide
dscm—dry cubic meter(s) at standard conditions
dscf—dry cubic feet at standard conditions
eq—equivalents
°F—degree Fahrenheit
g—gram(s)
gal—gallon(s)
g eq—gram equivalents
gr—grain(s)

hr—hour(s)
HCl—hydrochloric acid
Hg—mercury
H_2O—water
H_2S—hydrogen sulfide
H_2SO_4—sulfuric acid
in.—inch(es)
°K—degree Kelvin
k—1,000
kg—kilogram(s)
l—liter(s)
lpm—liter(s) per minute
lb—pound(s)
m—meter(s)
meq—milliequivalent(s)
min—minute(s)
mg—milligram(s)
ml—milliliter(s)
mm—millimeter(s)
mol. wt.—molecular weight
mV—millivolt
N_2—nitrogen
nm—nanometer(s)—10^{-9} meter
NO—nitric oxide
NO_2—nitrogen dioxide
NO_x—nitrogen oxides
O_2—oxygen
ppb—parts per billion
ppm—parts per million
psia—pounds per square inch absolute
°R—degree Rankine
s—at standard conditions
sec—second
SO_2—sulfur dioxide
SO_3—sulfur trioxide
μg—microgram(s)—10^{-6} gram

3. Section 60.4 is revised to read as follows:

§ 60.4 Address.

All requests, reports, applications, submittals, and other communications to the Administrator pursuant to this part shall be submitted in duplicate and addressed to the appropriate Regional Office of the Environmental Protection Agency, to the attention of the Director, Enforcement Division. The regional offices are as follows:

Region I (Connecticut, Maine, New Hampshire, Massachusetts, Rhode Island, Vermont), John F. Kennedy Federal Building, Boston, Massachusetts 02203.

Region II (New York, New Jersey, Puerto Rico, Virgin Islands), Federal Office Building, 26 Federal Plaza (Foley Square), New York, N.Y. 10007.

Region III (Delaware, District of Columbia, Pennsylvania, Maryland, Virginia, West Virginia), Curtis Building, Sixth and Walnut Streets, Philadelphia, Pennsylvania 19106.

Region IV (Alabama, Florida, Georgia, Mississippi, Kentucky, North Carolina, South Carolina, Tennessee), Suite 300, 1421 Peachtree Street, Atlanta, Georgia 30309.

Region V (Illinois, Indiana, Minnesota, Michigan, Ohio, Wisconsin), 1 North Wacker Drive, Chicago, Illinois 60606.

Region VI (Arkansas, Louisiana, New Mexico, Oklahoma, Texas), 1600 Patterson Street, Dallas, Texas 75201.

Region VII (Iowa, Kansas, Missouri, Nebraska), 1735 Baltimore Street, Kansas City, Missouri 64108.

Region VIII (Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming), 916 Lincoln Towers, 1860 Lincoln Street, Denver, Colorado 80203.

Region IX (Arizona, California, Hawaii, Nevada, Guam, American Samoa), 100 California Street, San Francisco, California 94111.

Region X (Washington, Oregon, Idaho, Alaska), 1200 Sixth Avenue, Seattle, Washington 98101.

4. In § 60.6, paragraph (b) is revised to read as follows:

§ 60.6 Review of plans.

* * * * *

(b) (1) A separate request shall be submitted for each construction or modification project.

(2) Each request shall identify the location of such project, and be accompanied by technical information describing the proposed nature, size, design, and method of operation of each affected facility involved in such project, including information on any requipment to be used for measurement or control of emissions.

5. In § 60.7 paragraph (d) is added as follows:

§ 60.7 Notification and recordkeeping.

* * * * *

(d) Any owner or operator subject to the provisions of this part shall maintain a file of all measurements, including monitoring and performance testing measurements, and all other reports and records required by all applicable subparts. Any such measurements, reports and records shall be retained for at least 2 years following the date of such measurements, reports, and records.

6. Section 60.8 is amended by revising paragraphs (b) and (f) and by deleting in paragraph (d) the number "10" after the word "Administrator" and substituting the number "30." The revised paragraphs (b) and (f) read as follows:

§ 60.8 Performance tests.

* * * * *

(b) Performance tests shall be conducted and data reduced in accordance with the test methods and procedures contained in each applicable subpart unless the Administrator (1) specifies or approves, in specific cases, the use of a reference method with minor changes in methodology, (2) approves the use of an equivalent method, (3) approves the use of an alternative method the results of which he has determined to be adequate for indicating whether a specific source is in compliance, or (4) waives the requirement for performance tests because the owner or operator of a source has demonstrated by other means to the Administrator's satisfaction that the affected facility is in compliance with the standard. Nothing in this paragraph shall be construed to abrogate the Administrator's authority to require testing under section 114 of the Act.

* * * * *

(f) Each performance test shall consist of three separate runs using the applicable test method. Each run shall be conducted for the time and under the conditions specified in the applicable standard. For the purpose of determining compliance with an applicable standard, the arithmetic means of results of the three runs shall apply. In the event that a sample is accidentally lost or conditions occur in which one of the three runs must be discontinued because of forced shutdown, failure of an irreplaceable portion of the sample train, extreme meteorological conditions, or other circumstances, beyond the owner or operator's control, compliance may, upon the Administrator's approval, be determined using the arithmetic mean of the results of the two other runs.

7. A new § 60.12 is added to subpart A as follows:

§ 60.12 Circumvention.

No owner or operator subject to the provisions of this part shall build, erect, install, or use any article, machine, equipment or process, the use of which conceals an emission which would otherwise constitute a violation of an applicable standard. Such concealment includes, but is not limited to, the use of gaseous diluents to achieve compliance with an opacity standard or with a standard which is based on the concentration of a pollutant in the gases discharged to the atmosphere.

8. In Part 60, Subparts I, J, K, L, M, N, and O are added as follows:

Subpart I—Standards of Performance for Asphalt Concrete Plants

§ 60.90 Applicability and designation of affected facility.

The affected facility to which the provisions of this subpart apply is each asphalt concrete plant. For the purpose of this subpart, an asphalt concrete plant is comprised only of any combination of the following: Dryers; systems for screening, handling, storing, and weighing hot aggregate; systems for loading, transferring, and storing mineral filler; systems for mixing asphalt concrete; and the loading, transfer, and storage systems associated with emission control systems.

§ 60.91 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in subpart A of this part.

(a) "Asphalt concrete plant" means any facility, as described in § 60.90, used to manufacture asphalt concrete by heating and drying aggregate and mixing with asphalt cements.

§ 60.92 Standard for particulate matter.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall discharge or cause the discharge into the atmosphere from any affected facility any gases which:

(1) Contain particulate matter in excess of 90 mg/dscm (0.04 gr/dscf).

(2) Exhibit 20 percent opacity, or greater. Where the presence of uncombined water is the only reason for failure to meet the requirements of this paragraph, such failure shall not be a violation of this section.

§ 60.93 Test methods and procedures.

(a) The reference methods appended to this part, except as provided for in § 60.8(b), shall be used to determine compliance with the standards prescribed in § 60.93 as follows:

(1) Method 5 for the concentration of particulate matter and the associated moisture content,

(2) Method 1 for sample and velocity traverses,

(3) Method 2 for velocity and volumetric flow rate, and

(4) Method 3 for gas analysis.

(b) For Method 5, the sampling time for each run shall be at least 60 minutes and the sampling rate shall be at least 0.9 dscm/hr (0.53 dscf/min) except that shorter sampling times, when necessitated by process variables or other factors, may be approved by the Administrator.

Subpart J—Standards of Performance for Petroleum Refineries

§ 60.100 Applicability and designation of affected facility.

The provisions of this subpart are applicable to the following affected facilities in petroleum refineries: Fluid catalytic cracking unit catalyst regenerators, fluid catalytic cracking unit incinerator-waste heat boilers, and fuel gas combustion devices.

§ 60.101 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in subpart A.

(a) "Petroleum refinery" means any facility engaged in producing gasoline, kerosene, distillate fuel oils, residual fuel oils, lubricants, or other products through distillation of petroleum or through redistillation, cracking or reforming of unfinished petroleum derivatives.

(b) "Petroleum" means the crude oil removed from the earth and the oils derived from tar sands, shale, and coal.

(c) "Process gas" means any gas generated by a petroleum refinery process unit, except fuel gas and process upset gas as defined in this section.

(d) "Fuel gas" means any gas which is generated by a petroleum refinery process unit and which is combusted, including any gaseous mixture of natural gas and fuel gas which is combusted.

(e) "Process upset gas" means any gas generated by a petroleum refinery process unit as a result of start-up, shut-down, upset or malfunction.

(f) "Refinery process unit" means any segment of the petroleum refinery in which a specific processing operation is conducted.

(g) "Fuel gas combustion device" means any equipment, such as process heaters, boilers and flares used to combust fuel gas, but does not include fluid coking unit and fluid catalytic cracking unit incinerator-waste heat boilers or facilities in which gases are combusted to produce sulfur or sulfuric acid.

(h) "Coke burn-off" means the coke removed from the surface of the fluid catalytic cracking unit catalyst by combustion in the catalyst regenerator. The rate of coke burn-off is calculated by the formula specified in § 60.106.

§ 60.102 Standard for particulate matter.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall discharge or cause the discharge into the atmosphere from any fluid catalytic cracking unit catalyst regenerator or from any fluid catalytic cracking unit incinerator-waste heat boiler:

(1) Particulate matter in excess of 1.0 kg/1000 kg (1.0 lb/1000 lb) of coke burn-off in the catalyst regenerator.

(2) Gases exhibiting 30 percent opacity or greater, except for 3 minutes in any 1 hour. Where the presence of uncombined water is the only reason for failure to meet the requirements of this subparagraph, such failure shall not be a violation of this section.

(b) In those instances in which auxiliary liquid or solid fossil fuels are burned in the fluid catalytic cracking unit incinerator-waste heat boiler, particular matter in excess of that permitted by paragraph (a)(1) of this section may be emitted to the atmosphere, except that the incremental rate of particulate emissions shall not exceed 0.18 g/million cal (0.10 1b/million Btu) of heat input attributable to such liquid or solid fuel.

§ 60.103 Standard for carbon monoxide.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall discharge or cause the discharge into the atmosphere from the fluid catalytic cracking unit catalyst regenerator any gases which contain carbon monoxide in excess of 0.050 percent by volume.

§ 60.104 Standard for sulfur dioxide.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall burn in any fuel gas combustion device any fuel gas which contains H_2S in excess of 230 mg/dscm (0.10 gr/dscf), except as provided in paragraph (b) of this section. The combustion of process upset gas in a flare, or the combustion in a flare of process gas or fuel gas which is released to the flare as a result of relief valve leakage, is exempt from this paragraph.

(b) The owner or operator may elect to treat the gases resulting from the combustion of fuel gas in a manner which limits the release of SO_2 to the atmosphere if it is shown to the satisfaction of the Administrator that this prevents SO_2 emissions as effectively as compliance with the requirements of paragraph (a) of this section.

§ 60.105 Emission monitoring.

(a) The owner or operator of any petroleum refinery subject to the provisions of this subpart shall install, calibrate, maintain, and operate monitoring instruments as follows:

(1) A photoelectric or other type smoke detector and recorder to continuously monitor and record the opacity of gases discharged into the atmosphere from the fluid catalytic cracking unit catalyst regenerator.

(2) An instrument for continuously monitoring and recording the concentration of CO in gases discharged into the atmosphere from fluid catalytic cracking unit catalyst regenerators, except where the requirements of paragraph (a)(3) of this section are met.

(3) Instruments for continuously monitoring and recording firebox temperature and O_2 concentration in the exhaust gases from any incinerator-waste heat boiler which combusts the exhaust gases from a fluid catalytic cracking unit catalyst regenerator except where the requirements of paragraph (a)(2) of this section are met.

(4) An instrument for continuously monitoring and recording concentrations of H_2S in fuel gases burned in any fuel gas combustion device, except where the requirements of § 60.104(b) are met. Fuel gas combustion devices having a common source of fuel gas may be monitored at one location if sampling at this location produces results representative of the H_2S concentration in the fuel gas burned.

(5) An instrument for continuously monitoring and recording concentrations of SO_2 in the gases discharged into the atmosphere from the combustion of fuel gases except where the requirements of § 60.104(a) are met.

(b) Instruments and sampling systems installed and used pursuant to this section shall meet specifications prescribed by the Administrator and each instrument shall be calibrated in accordance with the method prescribed by the manufacturer of such instrument. The instruments shall be subjected to the manufacturer's recommended zero adjustment and calibration procedures at least once per 24-hour operating period unless the manufacturer specifies or recommends calibration at shorter intervals, in which case such specifications or recommendations shall be followed.

(c) The average coke burn-off rate (thousands of kilogram/hr) and hours of operation for any fluid catalytic cracking unit catalyst regenerator subject to § 60.102 or 60.103 shall be recorded daily.

(d) For any fluid catalytic cracking unit catalyst regenerator which is subject to § 60.102 and which utilizes an incinerator-waste heat boiler to combust the exhaust gases from the catalyst regenerator, the owner or operator shall record daily the rate of combustion of liquid or solid fossil fuels (liters/hr or kilograms/hr) and the hours of operation during which liquid or solid fossil fuels are combusted in the incinerator-waste heat boiler.

(e) For the purpose of reports pursuant to § 60.7(c), periods of excess emissions that shall be reported are defined as follows:

(1) *Opacity*. All hourly periods in which there are four or more 1-minute periods during which the average opacity

of the gases discharged into the atmosphere from any fluid catalytic cracking unit catalyst regenerator subject to § 60.102 exceeds 30 percent.

(2) *Carbon monoxide.* All hourly periods during which the average carbon monoxide concentration in the gases discharged into the atmosphere from any fluid catalytic cracking unit catalyst regenerator subject to § 60.103 exceeds 0.050 percent by volume; or any hourly period in which O_2 concentration and firebox temperature measurements indicate that the average concentration of CO in the gases discharged into the atmosphere exceeds 0.050 percent by volume for sources which combust the exhaust gases from any fluid catalytic cracking unit catalyst regenerator subject to § 60.103 in an incinerator-waste heat boiler and for which the owner or operator elects to monitor in accordance with § 60.105(a) (3).

(3) *Hydrogen sulfide.* All hourly periods during which the average hydrogen sulfide content of any fuel gas combusted in any fuel gas combustion device subject to § 60.104 exceeds 230 mg/dscm (0.10 gr/dscf) except where the requirements of § 60.104(b) are met.

(4) *Sulfur dioxide.* All hourly periods during which the average sulfur dioxide emissions discharged into the atmosphere from any fuel gas combustion device subject to § 60.104 exceed the level specified in § 60.104(b), except where the requirements of § 60.104(a) are met.

§ 60.106 Test methods and procedures.

(a) For the purpose of determining compliance with § 60.102(a) (1), the following reference methods and calculation procedures shall be used:

(1) For gases released to the atmosphere from the fluid catalytic cracking unit catalyst regenerator:

(i) Method 5 for the concentration of particulate matter and moisture content,

(ii) Method 1 for sample and velocity traverses, and

(iii) Method 2 for velocity and volumetric flow rate.

(2) For Method 5, the sampling time for each run shall be at least 60 minutes and the sampling rate shall be at least 0.015 dscm/min (0.53 dscf/min), except that shorter sampling times may be approved by the Administrator when process variables or other factors preclude sampling for at least 60 minutes.

(3) For exhaust gases from the fluid catalytic cracking unit catalyst regenerator prior to the emission control system: the integrated sample techniques of Method 3 and Method 4 for gas analysis and moisture content, respectively; Method 1 for velocity traverses; and Method 2 for velocity and volumetric flow rate.

(4) Coke burn-off rate shall be determined by the following formula:

$$R_c=0.2982\,Q_{RE}\,(\%CO_2+\%CO)+2.088\,Q_{RA}-0.0994\,Q_{RE}\left(\frac{\%CO}{2}+\%CO_2+\%O_2\right)\ \text{(Metric Units)}$$

or

$$R_c=0.0186\,Q_{RE}\,(\%CO_2+\%CO)+0.1303\,Q_{RA}-0.0062\,Q_{RE}\left(\frac{\%CO}{2}+\%CO_2+\%O_2\right)\ \text{(English Units)}$$

where:

R_c=coke burn-off rate, kg/hr (English units: lb/hr).
0.2982=metric units material balance factor divided by 100, kg-min/hr-m^3.
0.0186=English units material balance factor divided by 100, lb-min/hr-ft^3.
Q_{RE}=fluid catalytic cracking unit catalyst regenerator exhaust gas flow rate before entering the emission control system, as determined by method 2, dscm/min (English units: dscf/min).
$\%CO_2$=percent carbon dioxide by volume, dry basis, as determined by Method 3.
% CO=percent carbon monoxide by volume, dry basis, as determined by Method 3.
% O_2=percent oxygen by volume, dry basis, as determined by Method 3.
2.088=metric units material balance factor divided by 100, kg-min/hr-m^3.
0.1303=English units material balance factor divided by 100, lb-min/hr-ft^3.
Q_{RA}=air rate to fluid catalytic cracking unit catalyst regenerator, as determined from fluid catalytic cracking unit control room instrumentation, dscm/min (English units: dscf/min).
0.0994=metric units material balance factor divided by 100, kg-min/hr-m^3.
0.0062=English units material balance factor divided by 100, lb-min/hr-ft^3.

(5) Particulate emissions shall be determined by the following equation:

$$R_E=(60\times10^{-6})Q_{RV}C_s\ \text{(Metric Units)}$$

$$R_E=(8.57\times10^{-3})Q_{RV}C_s\ \text{(English Units)}$$

where:

R_E=particulate emission rate, kg/hr (English units: lb/hr).
60×10^{-6}=metric units conversion factor, min-kg/hr-mg.
8.57×10^{-3}=English units conversion factor, min-lb/hr-gr.
Q_{RV}=volumetric flow rate of gases discharged into the atmosphere from the fluid catalytic cracking unit catalyst regenerator following the emission control system, as determined by Method 2, dscm/min (English units: dscf/min).
C_s=particulate emission concentration discharged into the atmosphere, as determined by Method 5, mg/dscm (English units: gr/dscf).

(6) For each run, emissions expressed in kg/1000 kg (English units: lb/1000 lb) of coke burn-off in the catalyst regenerator shall be determined by the following equation:

$$R_s=1000\frac{R_E}{R_c}\ \text{(Metric or English Units)}$$

where:

R_s=particulate emission rate, kg/1000 kg (English units: lb/1000 lb) of coke burn-off in the fluid catalytic cracking unit catalyst regenerator.
1000=conversion factor, kg to 1000 kg (English units: lb to 1000 lb).
R_E=particulate emission rate, kg/hr (English units: lb/hr).
R_c=coke burn-off rate, kg/hr (English units: lb/hr).

(7) In those instances in which auxiliary liquid or solid fossil fuels are burned in an incinerator-waste heat boiler, the rate of particulate matter emissions permitted under § 60.102(b) must be determined. Auxiliary fuel heat input, expressed in millions of cal/hr (English units: Millions of Btu/hr) shall be calculated for each run by fuel flow rate measurement and analysis of the liquid or solid auxiliary fossil fuels. For each run, the rate of particulate emissions permitted under § 60.102(b) shall be calculated from the following equation:

$$R_s=1.0+\frac{0.18\,H}{R_c}\ \text{(Metric Units)}$$

or

$$R_s=1.0+\frac{0.10\,H}{R_c}\ \text{(English Units)}$$

where:

R_s=allowable particulate emission rate, kg/1000 kg (English units: lb/1000 lb) of coke burn-off in the fluid catalytic cracking unit catalyst regenerator.
1.0=emission standard, 1.0 kg/1000 kg (English units: 1.0 lb/1000 lb) of coke burn-off in the fluid catalytic cracking unit catalyst regenerator.
0.18=metric units maximum allowable incremental rate of particulate emissions, g/million cal.
0.10=English units maximum allowable incremental rate of particulate emissions, lb/million Btu.

H=heat input from solid or liquid fossil fuel, million cal/hr (English units: million Btu/hr).
R_c=coke burn-off rate, kg/hr (English units: lb/hr).

(b) For the purpose of determining compliance with § 60.103, the integrated sample technique of Method 10 shall be used. The sample shall be extracted at a rate proportional to the gas velocity at a sampling point near the centroid of the duct. The sampling time shall not be less than 60 minutes.

(c) For the purpose of determining compliance with § 60.104(a), Method 11 shall be used. When refinery fuel gas lines are operating at pressures substantially above atmospheric, the gases sampled must be introduced into the sampling train at approximately atmospheric pressure. This may be accomplished with a flow control valve. If the line pressure is high enough to operate the sampling train without a vacuum pump, the pump may be eliminated from the sampling train. The sample shall be drawn from a point near the centroid of the fuel gas line. The minimum sampling time shall be 10 minutes and the minimum sampling volume 0.01 dscm (0.35 dscf) for each sample. The arithmetic average of two samples shall constitute one run. Samples shall be taken at approximately 1-hour intervals. For most fuel gases, sample times exceeding 20 minutes may result in depletion of the collecting solution, although fuel gases containing low concentrations of hydrogen sulfide may necessitate sampling for longer periods of time.

(d) Method 6 shall be used for determining concentration of SO_2 in determining compliance with § 60.104(b), except that H_2S concentration of the fuel gas may be determined instead. Method 1 shall be used for velocity traverses and Method 2 for determining velocity and volumetric flow rate. The sampling site for determining SO_2 concentration by Method 6 shall be the same as for determining volumetric flow rate by Method 2. The sampling point in the duct for determining SO_2 concentration by Method 6 shall be at the centroid of the cross section if the cross sectional area is less than 5 m^2 (54 ft^2) or at a point no closer to the walls than 1 m (39 inches) if the cross sectional area is 5 m^2 or more and the centroid is more than one meter from the wall. The sample shall be extracted at a rate proportional to the gas velocity at the sampling point. The minimum sampling time shall be 10 minutes and the minimum sampling volume 0.01 dscm (0.35 dscf) for each sample. The arithmetic average of two samples shall constitute one run. Samples shall be taken at approximately 1-hour intervals.

Subpart K—Standards of Performance for Storage Vessels for Petroleum Liquids

§ 60.110 Applicability and designation of affected facility.

(a) Except as provided in § 60.110(b), the affected facility to which this subpart applies is each storage vessel for petroleum liquids which has a storage capacity greater than 151,412 liters (40,000 gallons).

(b) This subpart does not apply to storage vessels for the crude petroleum or condensate stored, processed, and/or treated at a drilling and production facility prior to custody transfer.

§ 60.111 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in subpart A of this part.

(a) "Storage vessel" means any tank, reservoir, or container used for the storage of petroleum liquids, but does not include:

(1) Pressure vessels which are designed to operate in excess of 15 pounds per square inch gauge without emissions to the atmosphere except under emergency conditions,

(2) Subsurface caverns or porous rock reservoirs, or

(3) Underground tanks if the total volume of petroleum liquids added to and taken from a tank annually does not exceed twice the volume of the tank.

(b) "Petroleum liquids" means crude petroleum, condensate, and any finished or intermediate products manufactured in a petroleum refinery but does not mean Number 2 through Number 6 fuel oils as specified in ASTM-D-396-69, gas turbine fuel oils Numbers 2-GT through 4-GT as specified in ASTM-D-2880-71, or diesel fuel oils Numbers 2-D and 4-D as specified in ASTM-D-975-68.

(c) "Petroleum refinery" means any facility engaged in producing gasoline, kerosene, distillate fuel oils, residual fuel oils, lubricants, or other products through distillation of petroleum or through redistillation, cracking, or reforming of unfinished petroleum derivatives.

(d) "Crude petroleum" means a naturally occurring mixture which consists of hydrocarbons and/or sulfur, nitrogen and/or oxygen derivatives of hydrocarbons and which is a liquid at standard conditions.

(e) "Hydrocarbon" means any organic compound consisting predominantly of

(f) "Condensate" means hydrocarbon liquid separated from natural gas which condenses due to changes in the temperature and/or pressure and remains liquid at standard conditions.

(g) "Custody transfer" means the transfer of produced crude petroleum and/or condensate, after processing and/or treating in the producing operations, from storage tanks or automatic transfer facilities to pipelines or any other forms of transportation.

(h) "Drilling and production facility" means all drilling and servicing equipment, wells, flow lines, separators, equipment, gathering lines, and auxiliary nontransportation-related equipment used in the production of crude petroleum but does not include natural gasoline plants.

(i) "True vapor pressure" means the equilibrium partial pressure exerted by a petroleum liquid as determined in accordance with methods described in American Petroleum Institute Bulletin 2517, Evaporation Loss from Floating Roof Tanks, 1962.

(j) "Floating roof" means a storage vessel cover consisting of a double deck, pontoon single deck, internal floating cover or covered floating roof, which rests upon and is supported by the petroleum liquid being contained, and is equipped with a closure seal or seals to close the space between the roof edge and tank wall.

(k) "Vapor recovery system" means a vapor gathering system capable of collecting all hydrocarbon vapors and gases discharged from the storage vessel and a vapor disposal system capable of processing such hydrocarbon vapors and gases so as to prevent their emission to the atmosphere.

(l) "Reid vapor pressure" is the absolute vapor pressure of volatile crude oil and volatile non-viscous petroleum liquids, except liquified petroleum gases, as determined by ASTM-D-323-58 (reapproved 1968).

§ 61.112 Standard for hydrocarbons.

(a) The owner or operator of any storage vessel to which this subpart applies shall store petroleum liquids as follows:

(1) If the true vapor pressure of the petroleum liquid, as stored, is equal to or greater than 78 mm Hg (1.5 psia) but not greater than 570 mm Hg (11.1 psia), the storage vessel shall be equipped with a floating roof, a vapor recovery system, or their equivalents.

(2) If the true vapor pressure of the petroleum liquid as stored is greater than 570 mm Hg (11.1 psia), the storage vessel shall be equipped with a vapor recovery system or its equivalent.

§ 60.113 Monitoring of operations.

(a) The owner or operator of any storage vessel to which this subpart applies shall for each such storage vessel maintain a file of each type of petroleum liquid stored, of the typical Reid vapor pressure of each type of petroleum liquid stored, and of the dates of storage. Dates on which the storage vessel is empty shall be shown.

(b) The owner or operator of any storage vessel to which this subpart applies shall for each such storage vessel determine and record the average monthly storage temperature and true vapor pressure of the petroleum liquid stored at such temperature if:

(1) The petroleum liquid has a true vapor pressure, as stored, greater than 26 mm Hg (0.5 psia) but less than 78 mm Hg (1.5 psia) and is stored in a storage vessel other than one equipped with a floating roof, a vapor recovery system or their equivalents; or

(2) The petroleum liquid has a true vapor pressure, as stored, greater than 470 mm Hg (9.1 psia) and is stored in a storage vessel other than one equipped with a vapor recovery system or its equivalent.

(c) The average monthly storage temperature is an arithmetic average calculated for each calendar month, or portion thereof if storage is for less than a month, from bulk liquid storage temperatures determined at least once every 7 days.

(d) The true vapor pressure shall be determined by the procedures in API Bulletin 2517. This procedure is dependent upon determination of the storage temperature and the Reid vapor pressure, which requires sampling of the petroleum liquids in the storage vessels. Unless the Administrator requires in specific cases that the stored petroleum liquid be sampled, the true vapor pressure may be determined by using the average monthly storage temperature and the typical Reid vapor pressure. For those liquids for which certified specifications limiting the Reid vapor pressure exist, that Reid vapor pressure may be used. For other liquids, supporting analytical data must be made available on request to the Administrator when typical Reid vapor pressure is used.

Subpart L—Standards of Performance for Secondary Lead Smelters

§ 60.120 Applicability and designation of affected facility.

The provisions of this subpart are applicable to the following affected facilities in secondary lead smelters: Pot furnaces of more than 250 kg (550 lb) charging capacity, blast (cupola) furnaces, and reverberatory furnaces.

§ 60.121 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in subpart A of this part.

(a) "Reverberatory furnace" includes the following types of reverberatory furnaces: stationary, rotating, rocking, and tilting.

(b) "Secondary lead smelter" means any facility producing lead from a lead-bearing scrap material by smelting to the metallic form.

(c) "Lead" means elemental lead or allows in which the predominant component is lead.

§ 60.122 Standard for particulate matter.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall discharge or cause the discharge into the atmosphere from a blast (cupola) or reverberatory furnace any gases which:

(1) Contain particulate matter in excess of 50 mg/dscm (0.022 gr/dscf).

(2) Exhibit 20 percent opacity or greater.

(b) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall discharge or cause the discharge into the atmosphere from any pot furnace any gases which exhibit 10 percent opacity or greater.

(c) Where the presence of uncombined water is the only reason for failure to meet the requirements of paragraphs (a) (2) or (b) of this section, such failure shall not be a violation of this section.

§ 60.123 Test methods and procedures.

(a) The reference methods appended to this part, except as provided for in § 60.8 (b), shall be used to determine compliance with the standards prescribed in § 60.122 as follows:

(1) Method 5 for the concentration of particulate matter and the associated moisture content,

(2) Method 1 for sample and velocity traverses,

(3) Method 2 for velocity and volumetric flow rate, and

(4) Method 3 for gas analysis.

(b) For method 5, the sampling time for each run shall be at least 60 minutes and the sampling rate shall be at least 0.9 dscm/hr (0.53 dscf/min) except that shorter sampling times, when necessitated by process variables or other factors, may be approved by the Administrator. Particulate sampling shall be conducted during representative periods of furnace operation, including charging and tapping.

Subpart M—Standards of Performance for Secondary Brass and Bronze Ingot Production Plants

§ 60.130 Applicability and designation of affected facility.

The provisions of this subpart are applicable to the following affected facilities in secondary brass or bronze ingot production plants: Reverberatory and electric furnaces of 1,000 kg (2,205 lb) or greater production capacity and blast (cupola) furnaces of 250 kg/hr (550 lb/hr) or greater production capacity.

§ 60.131 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in subpart A of this part.

(a) "Brass or bronze" means any metal alloy containing copper as its predominant constituent, and lesser amounts of zinc, tin, lead, or other metals.

(b) "Reverberatory furnace" includes the following types of reverberatory furnaces: Stationary, rotating, rocking, and tilting.

(c) "Electric furnace" means any furnace which uses electricity to produce over 50 percent of the heat required in the production of refined brass or bronze.

(d) "Blast furnace" means any furnace used to recover metal from slag.

§ 60.132 Standard for particulate matter.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall discharge or cause the discharge into the atmosphere from a reverberatory furnace any gases which:

(1) Contain particulate matter in excess of 50 mg/dscm (0.022 gr/dscf).

(2) Exhibit 20 percent opacity or greater.

(b) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall discharge or cause the discharge into the atmosphere from any blast (cupola) or electric furnace any gases which exhibit 10 percent opacity or greater.

(c) Where the presence of uncombined water is the only reason for failure to meet the requirements of paragraphs (a)(2) or (b) of this section, such failure shall not be a violation of this section.

§ 60.133 Test methods and procedures.

(a) The reference methods appended to this part, except as provided for in § 60.8(b), shall be used to determine compliance with the standards prescribed in § 60.132 as follows:

(1) Method 5 for the concentration of particulate matter and the associated moisture content,

(2) Method 1 for sample and velocity traverses,

(3) Method 2 for velocity and volumetric flow rate, and

(4) Method 3 for gas analysis.

(b) For Method 5, the sampling time for each run shall be at least 120 minutes and the sampling rate shall be at least 0.9 dscm/hr (0.53 dscf/min) except that shorter sampling times, when necessitated by process variables or other factors, may be approved by the Administrator. Particulate matter sampling shall be conducted during representative periods of charging and refining, but not during pouring of the heat.

Subpart N—Standards of Performance for Iron and Steel Plants

§ 60.140 Applicability and designation of affected facility.

The affected facility to which the provisions of this subpart apply is each basic oxygen process furnace.

§ 60.141 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in subpart A of this part.

(a) "Basic oxygen process furnace" (BOPF) means any furnace producing steel by charging scrap steel, hot metal, and flux materials into a vessel and introducing a high volume of an oxygen-rich gas.

(b) "Steel production cycle" means the operations required to produce each batch of steel and includes the following major functions: Scrap charging, preheating (when used), hot metal charging, primary oxygen blowing, additional oxygen blowing (when used), and tapping.

§ 60.142 Standard for particulate matter.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall discharge or cause the discharge into the atmosphere from any affected facility any gases which:

(1) Contain particulate matter in excess of 50 mg/dscm (0.022 gr/dscf).

(2) [Reserved.]

§ 60.143 [Reserved]

§ 60.144 Test methods and procedures.

(a) The reference methods appended to this part, except as provided for in § 60.8(b), shall be used to determine compliance with the standards prescribed in § 60.142 as follows:

(1) Method 5 for concentration of particulate matter and associated moisture content,

(2) Method 1 for sample and velocity traverses,

(3) Method 2 for volumetric flow rate, and

(4) Method 3 for gas analysis.

(b) For Method 5, the sampling for each run shall continue for an integral number of cycles with total duration of at least 60 minutes. The sampling rate shall be at least 0.9 dscm/hr (0.53 dscf/min) except that shorter sampling times, when necessitated by process variables or other factors, may be approved by the Administrator. A cycle shall start at the beginning of either the scrap preheat or the oxygen blow and shall terminate immediately prior to tapping.

Subpart O—Standards of Performance for Sewage Treatment Plants

§ 60.150 Applicability and designation of affected facility.

The affected facility to which the provisions of this subpart apply is each incinerator which burns the sludge produced by municipal sewage treatment facilities.

§ 60.151 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in subpart A of this part.

§ 60.152 Standard for particulate matter.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator of any sewage sludge incinerator subject to the provisions of this subpart shall discharge or cause the discharge into the atmosphere of:

(1) Particulate matter at a rate in excess of 0.65 g/kg dry sludge input (1.30 lb/ton dry sludge input).

(2) Any gases which exhibit 20 percent opacity or greater. Where the presence of uncombined water is the only reason for failure to meet the requirements of this paragraph, such failure shall not be a violation of this section.

§ 60.153 Monitoring of operations.

(a) The owner or operator of any sludge incinerator subject to the provisions of this subpart shall:

(1) Install, calibrate, maintain, and operate a flow measuring device which can be used to determine either the mass or volume of sludge charged to the incinerator. The flow measuring device shall have an accuracy of ±5 percent over its operating range.

(2) Provide access to the sludge charged so that a well-mixed representative grab sample of the sludge can be obtained.

§ 60.154 Test Methods and Procedures.

(a) The reference methods appended to this part, except as provided for in § 60.8(b), shall be used to determine compliance with the standards prescribed in § 60.152 as follows:

(1) Method 5 for concentration of particulate matter and associated moisture content,

(2) Method 1 for sample and velocity traverses,

(3) Method 2 for volumetric flow rate, and

(4) Method 3 for gas analysis.

(b) For Method 5, the sampling time for each run shall be at least 60 minutes and the sampling rate shall be at least 0.015 dscm/min (0.53 dscf/min), except that shorter sampling times, when necessitated by process variables or other factors, may be approved by the Administrator.

(c) Dry sludge charging rate shall be determined as follows:

(1) Determine the mass (S_M) or volume (S_V) of sludge charged to the incinerator during each run using a flow measuring device meeting the requirements of § 60.153(a)(1). If total input during a run is measured by a flow measuring device, such readings shall be used. Otherwise, record the flow measuring device readings at 5-minute intervals during a run. Determine the quantity charged during each interval by averaging the flow rates at the beginning and end of the interval and then multiplying the average for each interval by the time for each interval. Then add the quantity for each interval to determine the total quantity charged during the entire run, (S_M) or (S_V).

(2) Collect samples of the sludge charged to the incinerator in non-porous collecting jars at the beginning of each run and at approximately 1-hour intervals thereafter until the test ends, and determine for each sample the dry sludge content (total solids residue) in accordance with "224 G. Method for Solid and Semisolid Samples," *Standard Methods for the Examination of Water and Wastewater*, Thirteenth Edition, American Public Health Association, Inc., New York, N.Y., 1971, pp. 539–41, except that:

(i) Evaporating dishes shall be ignited to at least 103°C rather than the 550°C specified in step 3(a)(1).

(ii) Determination of volatile residue, step 3(b) may be deleted.

(iii) The quantity of dry sludge per unit sludge charged shall be determined in terms of either R_{DV} (metric units: mg dry sludge/liter sludge charged or English units: lb/ft³) or R_{DM} (metric units: mg dry sludge/mg sludge charged or English units: lb/lb).

(3) Determine the quantity of dry sludge per unit sludge charged in terms of either R_{DV} or R_{DM}.

(i) If the volume of sludge charged is used:

$$S_D=(60\times10^{-3})\frac{R_{DV}S_V}{T}\text{ (Metric Units)}$$

or

$$S_D=(8.021)\frac{R_{DV}S_V}{T}\text{ (English Units)}$$

where:

S_D=average dry sludge charging rate during the run, kg/hr (English units: lb/hr).
R_{DV}=average quantity of dry sludge per unit volume of sludge charged to the incinerator, mg/l (English units: lb/ft³).
S_V=sludge charged to the incinerator during the run, m³ (English units: gal).
T=duration of run, min (English units: min).
60×10^{-3}=metric units conversion factor, l-kg-min/m³-mg-hr.
8.021=English units conversion factor, ft³-min/gal-hr.

(ii) If the mass of sludge charged is used:

$$S_D=(60)\frac{R_{DM}S_M}{T}\text{ (Metric or English Units)}$$

where:

S_D=average dry sludge charging rate during the run, kg/hr (English units: lb/hr).
R_{DM}=average ratio of quantity of dry sludge to quantity of sludge charged to the incinerator, mg/mg (English units: lb/lb).
S_M=sludge charged during the run, kg (English units: lb).
T=duration of run, min (Metric or English units).
60=conversion factor, min/hr (Metric or English units).

(d) Particulate emission rate shall be determined by:

$$c_sW=c_sQ_s\text{ (Metric or English Units)}$$

where:

c_{sw}=particulate matter mass emissions, mg/hr (English units: lb/hr).
c_s=particulate matter concentration, mg/m³ (English units: lb/dscf).
Q_s=volumetric stack gas flow rate; dscm/hr (English units: dscf/hr). Q_s and c_s shall be determined using Methods 2 and 5, respectively.

(e) Compliance with § 60.152(a) shall be determined as follows:

$$C_{ds}=(10^{-3})\frac{c_{sw}}{S_D}\text{ (Metric Units)}$$

or

$$C_{ds}=(2000)\frac{c_{sw}}{S_D}\text{ (English Units)}$$

where:

C_{ds}=particulate emission discharge, g/kg dry sludge (English units: lb/ton dry sludge).
10^{-3}=Metric conversion factor, g/mg.
2000=English conversion factor, lb/ton.

9. Methods 10 and 11 are added to the appendix as follows:

METHOD 10—DETERMINATION OF CARBON MONOXIDE EMISSIONS FROM STATIONARY SOURCES

1. *Principle and Applicability.*

1.1 *Principle.* An integrated or continuous gas sample is extracted from a sampling point and analyzed for carbon monoxide (CO) content using a Luft-type nondispersive infrared analyzer (NDIR) or equivalent.

1.2 *Applicability.* This method is applicable for the determination of carbon monoxide emissions from stationary sources only when specified by the test procedures for determining compliance with new source performance standards. The test procedure will indicate whether a continuous or an integrated sample is to be used.

2. *Range and sensitivity.*

2.1 *Range.* 0 to 1,000 ppm.

2.2 *Sensitivity.* Minimum detectable concentration is 20 ppm for a 0 to 1,000 ppm span.

3. *Interferences.* Any substance having a strong absorption of infrared energy will interfere to some extent. For example, discrimination ratios for water (H_2O) and carbon dioxide (CO_2) are 3.5 percent H_2O per 7 ppm CO and 10 percent CO_2 per 10 ppm CO, respectively, for devices measuring in the 1,500 to 3,000 ppm range. For devices meas-

uring in the 0 to 100 ppm range, interference ratios can be as high as 3.5 percent H_2O per 25 ppm CO and 10 percent CO_2 per 50 ppm CO. The use of silica gel and ascarite traps will alleviate the major interference problems. The measured gas volume must be corrected if these traps are used.

4. *Precision and accuracy.*

4.1 *Precision.* The precision of most NDIR analyzers is approximately ±2 percent of span.

4.2 *Accuracy.* The accuracy of most NDIR analyzers is approximately ±5 percent of span after calibration.

5. *Apperatus.*

5.1 *Continuous sample* (Figure 10–1).

5.1.1 *Probe.* Stainless steel or sheathed Pyrex[1] glass, equipped with a filter to remove particulate matter.

5.1.2 *Air-cooled condenser or equivalent.* To remove any excess moisture.

5.2 *Integrated sample* (Figure 10–2).

5.2.1 *Probe.* Stainless steel or sheathed Pyrex glass, equipped with a filter to remove particulate matter.

5.2.2 *Air-cooled condenser or equivalent.* To remove any excess moisture.

5.2.3 *Valve.* Needle valve, or equivalent, to to adjust flow rate.

5.2.4 *Pump.* Leak-free diaphragm type, or equivalent, to transport gas.

5.2.5 *Rate meter.* Rotameter, or equivalent, to measure a flow range from 0 to 1.0 liter per min. (0.035 cfm).

5.2.6 *Flexible bag.* Tedlar, or equivalent, with a capacity of 60 to 90 liters (2 to 3 ft^3). Leak-test the bag in the laboratory before using by evacuating bag with a pump followed by a dry gas meter. When evacuation is complete, there should be no flow through the meter.

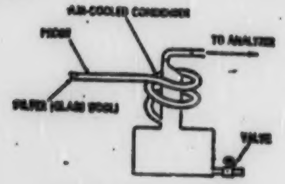

Figure 10-1. Continuous sampling train.

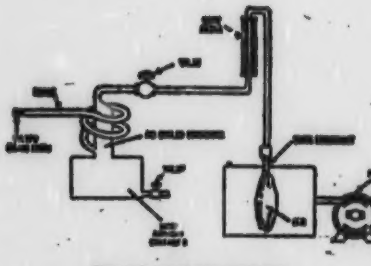

Figure 10-2. Integrated gas-sampling train.

5.2.7 *Pitot tube.* Type S, or equivalent, attached to the probe so that the sampling rate can be regulated proportional to the stack gas velocity when velocity is varying with the time or a sample traverse is conducted.

5.3 *Analysis* (Figure 10–3).

5.3.1 *Carbon monoxide analyzer.* Nondispersive infrared spectrometer, or equivalent. This instrument should be demonstrated, preferably by the manufacturer, to meet or exceed manufacturer's specifications and those described in this method.

5.3.2 *Drying tube.* To contain approximately 200 g of silica gel.

5.3.3 *Calibration gas.* Refer to paragraph 6.1.

5.3.4 *Filter.* As recommended by NDIR manufacturer.

5.3.5 *CO_2 removal tube.* To contain approximately 500 g of ascarite.

5.3.6 *Ice-water bath.* For ascarite and silica gel tubes.

5.3.7 *Valve.* Needle valve, or equivalent, to adjust flow rate

5.3.8 *Rate meter.* Rotameter or equivalent to measure gas flow rate of 0 to 1.0 liter per min. (0.035 cfm) through NDIR.

5.3.9 *Recorder* (*optional*). To provide permanent record of NDIR readings.

6. *Reagents.*

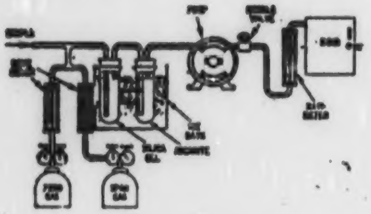

Figure 10-3. Analytical equipment.

6.1 *Calibration gases.* Known concentration of CO in nitrogen (N_2) for instrument span, prepurified grade of N_2 for zero, and two additional concentrations corresponding approximately to 60 percent and 30 percent span. The span concentration shall not exceed 1.5 times the applicable source performance standard. The calibration gases shall be certified by the manufacturer to be within ±2 percent of the specified concentration.

6.2 *Silica gel.* Indicating type, 6 to 16 mesh, dried at 175° C (347° F) for 2 hours.

6.3 *Ascarite.* Commercially available.

7. *Procedure.*

7.1 *Sampling.*

7.1.1 *Continuous sampling.* Set up the equipment as shown in Figure 10–1 making sure all connections are leak free. Place the probe in the stack at a sampling point and purge the sampling line. Connect the analyzer and begin drawing sample into the analyzer. Allow 5 minutes for the system to stabilize, then record the analyzer reading as required by the test procedure. (See § 7.2 and 8). CO_2 content of the gas may be determined by using the Method 3 integrated sample procedure (36 FR 24886), or by weighing the ascarite CO_2 removal tube and computing CO_2 concentration from the gas volume sampled and the weight gain of the tube.

7.1.2 *Integrated sampling.* Evacuate the flexible bag. Set up the equipment as shown in Figure 10–2 with the bag disconnected. Place the probe in the stack and purge the sampling line. Connect the bag, making sure that all connections are leak free. Sample at a rate proportional to the stack velocity. CO_2 content of the gas may be determined by using the Method 3 integrated sample procedures (36 FR 24886), or by weighing the ascarite CO_2 removal tube and computing CO_2 concentration from the gas volume sampled and the weight gain of the tube.

7.2 *CO Analysis.* Assemble the apparatus as shown in Figure 10–3, calibrate the instrument, and perform other required operations as described in paragraph 8. Purge analyzer with N_2 prior to introduction of each sample. Direct the sample stream through the instrument for the test period, recording the readings. Check the zero and span again after the test to assure that any drift or malfunction is detected. Record the sample data on Table 10–1.

8. *Calibration.* Assemble the apparatus according to Figure 10–3. Generally an instrument requires a warm-up period before stability is obtained. Follow the manufacturer's instructions for specific procedure. Allow a minimum time of one hour for warm-up. During this time check the sample conditioning apparatus, i.e., filter, condenser, drying tube, and CO_2 removal tube, to ensure that each component is in good operating condition. Zero and calibrate the instrument according to the manufacturer's procedures using, respectively, nitrogen and the calibration gases.

TABLE 10–1.—*Field data*

Location ______________________ Comments:
Test ______________________
Date ______________________
Operator ______________________

Clock time	*Rotameter setting, liters per minute (cubic feet per minute)*

9. *Calculation—Concentration of carbon monoxide.* Calculate the concentration of carbon monoxide in the stack using equation 10–1.

$$C_{CO_{stack}} = C_{CO_{NDIR}}(1 - F_{CO_2}) \qquad \text{equation 10–1}$$

where:

$C_{CO_{stack}}$ = concentration of CO in stack, ppm by volume (dry basis).

$C_{CO_{NDIR}}$ = concentration of CO measured by NDIR analyzer, ppm by volume (dry basis).

F_{CO_2} = volume fraction of CO_2 in sample, i.e., percent CO_2 from Orsat analysis divided by 100.

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[1] Mention of trade names or specific products does not constitute endorsement by the Environmental Protection Agency.

10. *Bibliography.*

10.1 McElroy, Frank, The Intertech NDIR-CO Analyzer, Presented at 11th Methods Conference on Air Pollution, University of California, Berkeley, Calif., April 1, 1970.

10.2 Jacobs, M. B., et al., Continuous Determination of Carbon Monoxide and Hydrocarbons in Air by a Modified Infrared Analyzer, J. Air Pollution Control Association, 9(2):110-114, August 1959.

10.3 MSA LIRA Infrared Gas and Liquid Analyzer Instruction Book, Mine Safety Appliances Co., Technical Products Division, Pittsburgh, Pa.

10.4 Models 215A, 315A, and 415A Infrared Analyzers, Beckman Instruments, Inc., Beckman Instructions 1635-B, Fullerton, Calif., October 1967.

10.5 Continuous CO Monitoring System, Model A5611, Intertech Corp., Princeton, N.J.

10.6 UNOR Infrared Gas Analyzers, Bendix Corp., Ronceverte, West Virginia.

ADDENDA

A. Performance Specifications for NDIR Carbon Monoxide Analyzers.

Range (minimum)	0-1000ppm.
Output (minimum)	0-10mV.
Minimum detectable sensitivity	20 ppm.
Rise time, 90 percent (maximum)	30 seconds.
Fall time, 90 percent (maximum)	30 seconds.
Zero drift (maximum)	10% in 8 hours.
Span drift (maximum)	10% in 8 hours.
Precision (minimum)	± 2% of full scale.
Noise (maximum)	± 1% of full scale.
Linearity (maximum deviation)	2% of full scale.
Interference rejection ratio	CO_2—1000 to 1, H_2O—500 to 1.

B. *Definitions of Performance Specifications.*

Range—The minimum and maximum measurement limits.

Output—Electrical signal which is proportional to the measurement; intended for connection to readout or data processing devices. Usually expressed as millivolts or milliamps full scale at a given impedance.

Full scale—The maximum measuring limit for a given range.

Minimum detectable sensitivity—The smallest amount of input concentration that can be detected as the concentration approaches zero.

Accuracy—The degree of agreement between a measured value and the true value; usually expressed as ± percent of full scale.

Time to 90 percent response—The time interval from a step change in the input concentration at the instrument inlet to a reading of 90 percent of the ultimate recorded concentration.

Rise Time (90 percent)—The interval between initial response time and time to 90 percent response after a step increase in the inlet concentration.

Fall Time (90 percent)—The interval between initial response time and time to 90 percent response after a step decrease in the inlet concentration.

Zero Drift—The change in instrument output over a stated time period, usually 24 hours, of unadjusted continuous operation when the input concentration is zero; usually expressed as percent full scale.

Span Drift—The change in instrument output over a stated time period, usually 24 hours, of unadjusted continuous operation when the input concentration is a stated upscale value; usually expressed as percent full scale.

Precision—The degree of agreement between repeated measurements of the same concentration, expressed as the average deviation of the single results from the mean.

Noise—Spontaneous deviations from a mean output not caused by input concentration changes.

Linearity—The maximum deviation between an actual instrument reading and the reading predicted by a straight line drawn between upper and lower calibration points.

METHOD 11—DETERMINATION OF HYDROGEN SULFIDE EMISSIONS FROM STATIONARY SOURCES

1. *Principle and applicability.*

1.1 *Principle.* Hydrogen sulfide (H_2S) is collected from the source in a series of midget impingers and reacted with alkaline cadmium hydroxide [$Cd(OH)_2$] to form cadmium sulfide (CdS). The precipitated CdS is then dissolved in hydrochloric acid and absorbed in a known volume of iodine solution. The iodine consumed is a measure of the H_2S content of the gas. An impinger containing hydrogen peroxide is included to remove SO_2 as an interfering species.

1.2 *Applicability.* This method is applicable for the determination of hydrogen sulfide emissions from stationary sources only when specified by the test procedures for determining compliance with the new source performance standards.

2. *Apparatus.*

2.1 *Sampling train.*

2.1.1 *Sampling line*—6- to 7-mm (¼-inch) Teflon[1] tubing to connect sampling train to sampling valve, with provisions for heating to prevent condensation. A pressure reducing valve prior to the Teflon sampling line may be required depending on sampling stream pressure.

2.1.2 *Impingers*—Five midget impingers, each with 30-ml capacity, or equivalent.

2.1.3 *Ice bath container*—To maintain absorbing solution at a constant temperature.

2.1.4 *Silica gel drying tube*—To protect pump and dry gas meter.

2.1.5 *Needle valve, or equivalent*—Stainless steel or other corrosion resistant material, to adjust gas flow rate.

2.1.6 *Pump*—Leak free, diaphragm type, or equivalent, to transport gas. (Not required if sampling stream under positive pressure.)

2.1.7 *Dry gas meter*—Sufficiently accurate to measure sample volume to within 1 percent.

2.1.8 *Rate meter*—Rotameter, or equivalent, to measure a flow rate of 0 to 3 liters per minute (0.1 ft^3/min).

2.1.9 *Graduated cylinder*—25 ml.

2.1.10 *Barometer*—To measure atmospheric pressure within ±2.5 mm (0.1 in.) Hg.

2.2 *Sample Recovery.*

2.2.1 *Sample container*—500-ml glass stoppered iodine flask.

2.2.2 *Pipette*—50-ml volumetric type.

2.2.3 *Beakers*—250 ml.

2.2.4 *Wash bottle*—Glass.

2.3 *Analysis.*

2.3.1 *Flask*—500-ml glass-stoppered iodine flask.

2.3.2 *Burette*—One 50 ml.

2.3.3 *Flask*—125-ml conical.

3. *Reagents.*

3.1 *Sampling.*

3.1.1 *Absorbing solution*—Cadmium hydroxide ($Cd(OH)_2$)—Mix 4.3 g cadmium sulfate hydrate ($3\ CdSO_4 \cdot 8H_2O$) and 0.3 g of sodium hydroxide (NaOH) in 1 liter of distilled water (H_2O). Mix well.

Note: The cadmium hydroxide formed in this mixture will precipitate as a white suspension. Therefore, this solution must be thoroughly mixed before using to ensure an even distribution of the cadmium hydroxide.

3.1.2 *Hydrogen peroxide, 3 percent*—Dilute 30 percent hydrogen peroxide to 3 percent as needed. Prepare fresh daily;

3.2 *Sample recovery.*

3.2.1 *Hydrochloric acid solution (HCl), 10 percent by weight*—Mix 230 ml of concentrated HCl (specific gravity 1.19) and 770 ml of distilled H_2O.

3.2.2 *Iodine solution, 0.1 N*—Dissolve 24 g potassium iodide (KI) in 30 ml of distilled H_2O in a 1-liter graduated cylinder. Weigh 12.7 g of resublimed iodine (I_2) into a weighing bottle and add to the potassium iodide solution. Shake the mixture until the iodine is completely dissolved. Slowly dilute the solution to 1 liter with distilled H_2O, with swirling. Filter the solution, if cloudy, and store in a brown glass-stoppered bottle.

3.2.3 *Standard iodine solution, 0.01 N*—Dilute 100 ml of the 0.1 *N* iodine solution in a volumetric flask to 1 liter with distilled water.

Standardize daily as follows: Pipette 25 ml of the 0.01 *N* iodine solution into a 125-ml conical flask. Titrate with standard 0.01 *N* thiosulfate solution (see paragraph 3.3.2) until the solution is a light yellow. Add a few drops of the starch solution and continue titrating until the blue color just disappears. From the results of this titration, calculate the exact normality of the iodine solution (see paragraph 5.1).

3.2.4 *Distilled, deionized water.*

3.3 *Analysis.*

3.3.1 *Sodium thiosulfate solution, standard 0.1 N*—For each liter of solution, dissolve 24.8 g of sodium thiosulfate ($NA_2S_2O_3 \cdot 5H_2O$) in distilled water and add 0.01 g of anhydrous sodium carbonate (Na_2CO_3) and 0.4 ml of chloroform ($CHCl_3$) to stabilize. Mix thoroughly by shaking or by aerating with nitrogen for approximately 15 minutes, and store in a glass-stoppered glass bottle.

Standardize frequently as follows: Weigh into a 500-ml volumetric flask about 2 g of potassium dichromate ($K_2Cr_2O_7$) weighed to the nearest milligram and dilute to the 500-ml mark with distilled H_2O. Use dichromate which has been crystallized from distilled water and oven-dried at 182°C to 199°C (360°F to 390°F). Dissolve approximately 3 g of potassium iodide (KI) in 50 ml of distilled water in a glass-stoppered, 500-ml conical flask, then add 5 ml of 20-percent hydrochloric acid solution. Pipette 50 ml of the dichromate solution into this mixture. Gently swirl the solution once and allow it to stand in the dark for 5 minutes. Dilute the solution with 100 to 200 ml of distilled water, washing down the sides of the flask with part of the water. Swirl the solution slowly and titrate with the thoisulfate solution until the solution is light yellow. Add 4 ml of starch solution and continue with a slow titration with the thiosulfate until the bright blue color has disappeared and only the pale green color of the chromic ion remains. From this titration, calculate the exact normality of the sodium thiosulfate solution (see paragraph 5.2).

3.3.2 *Sodium thiosulfate solution, standard 0.01 N*—Pipette 100 ml of the standard 0.1 *N* thiosulfate solution into a volumetric flask and dilute to one liter with distilled water.

---

[1] Mention of trade names or specific products does not constitute endorsement by the Environmental Protection Agency.

3.3.3 *Starch indicator solution*—Suspend 10 g of soluble starch in 100 ml of distilled water and add 15 g of potassium hydroxide pellets. Stir until dissolved, dilute with 900 ml of distilled water, and let stand 1 hour. Neutralize the alkali with concentrated hydrochloric acid, using an indicator paper similar to Alkacid test ribbon, then add 2 ml of glacial acetic acid as a preservative.

Test for decomposition by titrating 4 ml of starch solution in 200 ml of distilled water with 0.01 *N* iodine solution. If more than 4 drops of the 0.01 *N* iodine solution are required to obtain the blue color, make up a fresh starch solution.

4. *Procedure.*

4.1 *Sampling.*

4.1.1 Assemble the sampling train as shown in Figure 11-1, connecting the five midget impingers in series. Place 15 ml of 3 percent hydrogen peroxide in the first impinger. Place 15 ml of the absorbing solution in each of the next three impingers, leaving the fifth dry. Place crushed ice around the impingers. Add more ice during the run to keep the temperature of the gases leaving the last impinger at about 20°C (70°F), or less.

4.1.2 Purge the connecting line between the sampling valve and the first impinger. Connect the sample line to the train. Record the initial reading on the dry gas meter as shown in Table 11-1.

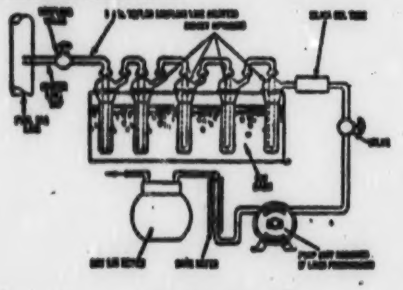

Figure 11-1. H₂S sampling train.

TABLE 11-1.—*Field data*

Location .... Comments:

Test ....

Date ....

Operator ....

Barometric pressure...

Clock time	Gas volume through meter (V_m), liters (cubic feet)	Rotameter setting, Lpm (cubic feet per minute)	Meter temperature, °C (°F)

4.1.3 Open the flow control valve and adjust the sampling rate to 1.13 liters per minute (0.04 cfm). Read the meter temperature and record on Table 11-1.

4.1.4 Continue sampling a minimum of 10 minutes. If the yellow color of cadmium sulfide is visible in the third impinger, analysis should confirm that the applicable standard has been exceeded. At the end of the sample time, close the flow control valve and read the final meter volume and temperature.

4.1.5 Disconnect the impinger train from the sampling line. Purge the train with clean ambient air for 15 minutes to ensure that all H_2S is removed from the hydrogen peroxide. Cap the open ends and move to the sample clean-up area.

4.2 *Sample recovery.*

4.2.1 Pipette 50 ml of 0.01 *N* iodine solution into a 250-ml beaker. Add 50 ml of 10 percent HCl to the solution. Mix well.

4.2.2 Discard the contents of the hydrogen peroxide impinger. Carefully transfer the contents of the remaining four impingers to a 500-ml iodine flask.

4.2.3 Rinse the four absorbing impingers and connecting glassware with three portions of the acidified iodine solution. Use the entire 100 ml of acidified iodine for this purpose. Immediately after pouring the acidified iodine into an impinger, stopper it and shake for a few moments before transferring the rinse to the iodine flask. Do not transfer any rinse portion from one impinger to another; transfer it directly to the iodine flask. Once acidified iodine solution has been poured into any glassware containing cadmium sulfide sample, the container must be tightly stoppered at all times except when adding more solution, and this must be done as quickly and carefully as possible. After adding any acidified iodine solution to the iodine flask, allow a few minutes for absorption of the H_2S into the iodine before adding any further rinses.

4.2.2 Titrate the blanks in the same manner as the samples.

4.2.4 Follow this rinse with two more rinses using distilled water. Add the distilled water rinses to the iodine flask. Stopper the flask and shake well. Allow about 30 minutes for absorption of the H_2S into the iodine, then complete the analysis titration.

Caution: Keep the iodine flask stoppered except when adding sample or titrant.

4.2.5 Prepare a blank in an iodine flask using 45 ml of the absorbing solution, 50 ml of 0.01 *N* iodine solution, and 50 ml of 10 percent HCl. Stopper the flask, shake well and analyze with the samples.

4.3 *Analysis.*

Note: This analysis titration should be conducted at the sampling location in order to prevent loss of iodine from the sample. Titration should never be made in direct sunlight.

4.3.1 Titrate the solution in the flask with 0.01 *N* sodium thiosulfate solution until the solution is light yellow. Add 4 ml of the starch indicator solution and continue titrating until the blue color just disappears.

5. *Calculations.*

5.1 *Normality of the standard iodine solution.*

$$N_I = \frac{N_T V_T}{V_I} \qquad \text{equation 11-1}$$

where:

N_I = normality of iodine, g-eq/liter.
V_I = volume of iodine used, ml.
N_T = normality of sodium thiosulfate, g-eq/liter.
V_T = volume of sodium thiosulfate used, ml.

5.2 *Normality of the standard thiosulfate solution.*

$$N_T = 2.04 \frac{W}{V_T} \qquad \text{equation 11-2}$$

where:

W = weight of $K_2Cr_2O_7$ used, g.
V_T = volume of $Na_2S_2O_3$ used, ml.
N_T = normality of standard thiosulfate solution, g-eq/liter.
2.04 = conversion factor

$$= \frac{(6 \text{ eq } I_2/\text{mole } K_2Cr_2O_7)\ (1{,}000 \text{ ml/l})}{(294.2 \text{ g } K_2Cr_2O_7/\text{mole})\ (10 \text{ aliquot factor})}.$$

5.3 *Dry gas volume.* Correct the sample volume measured by the dry gas meter to standard conditions [21°C(70°F)] and 760 mm (29.92 inches) Hg] by using equation 11-3.

$$V_{m_{std}} = V_m \left(\frac{T_{std}}{T_m}\right) \left(\frac{P_{bar}}{P_{std}}\right) \qquad \text{equation 11-3}$$

where:

$V_{m_{std}}$ = volume at standard conditions of gas sample through the dry gas meter, standard liters (scf).
V_m = volume of gas sample through the dry gas meter (meter conditions), liters (cu. ft.).
T_{std} = absolute temperature at standard conditions, 294°K (530°R).
T_m = average dry gas meter temperature, °K (°R).
P_{bar} = barometric pressure at the orifice meter, mm Hg (in. Hg).
P_{std} = absolute pressure at standard conditions, 760 mm Hg (29.92 in. Hg).

5.4 *Concentration of H_2S.*—Calculate the concentration of H_2S in the gas stream at standard conditions using equation 11-4:

$$C_{H_2S} = \frac{K[(V_I N_I - V_T N_T)_{sample} - (V_I N_I - V_T N_T)_{blank}]}{V_{m_{std}}}$$

where (metric units):

C_{H_2S} = concentration of H_2S at standard conditions, mg/dscm
K = conversion factor = 17.0×10^3

$$= \frac{(34.07 \text{ g/mole } H_2S)(1{,}000 \text{ l/m}^3)(1{,}000 \text{ mg/g})}{(1{,}000 \text{ ml/l})(2H_2S \text{ eq/mole})}$$

V_I = volume of standard iodine solution, ml.
N_I = normality of standard iodine solution, g-eq/liter.
V_T = volume of standard sodium thiosulfate solution, ml.
N_T = normality of standard sodium thiosulfate solution, g-eq/liter.
$V_{m_{std}}$ = dry gas volume at standard conditions, liters.

where (English units):

$$K=0.263=\frac{17.0(15.43\ gr/g)}{(1,000\ l/m^3}$$

$V_{m_{std}}$=scf.

C_{H_2S}=gr/dscf.

6. *References.*

6.1 Determination of Hydrogen Sulfide, Ammoniacal Cadmium Chloride Method, API Method 772-54. In: Manual on Disposal of Refinery Wastes, Vol. V: Sampling and Analysis of Waste Gases and Particulate Matter, American Petroleum Institute, Washington, D.C., 1954.

6.2 Tentative Method for Determination of Hydrogen Sulfide and Mercaptan Sulfur in Natural Gas, Natural Gas Processors Association, Tulsa, Oklahoma, NGPA Publication No. 2265-65, 1965.

[FR Doc.74-4784 Filed 3-7-74;8:45 am]

Title 40—Protection of Environment

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

SUBCHAPTER C—AIR PROGRAMS

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Additions and Miscellaneous Amendments

Correction

In FR Doc. 74-4784 appearing at page 9307 as the Part II of the issue of Friday, March 8, 1974, make the following changes:

1. After the last line of § 60.111(e), insert "carbon and hydrogen".

2. In the second column on page 9317, what is now designated as "§ 61.112 Standard for hydrocarbons", should read "§ 60.112 Standard for hydrocarbons".

3. In the second line of § 60.121(c), the word "allows" should read "alloys".

4. In § 60.154:

a. In the last line of the formula in paragraph (c)(3)(i), "ft^{3}" should read "ft^{2}".

b. In the first line of the formula in paragraph (c)(3)(ii), "$S_D=(50)$" should read "$S_D=(60)$".

c. The formula in paragraph (d) should read as follows:

$$C_{ds}=(10^{-3})\frac{c_{sw}}{S_D}\quad \text{(Metric Units)}$$

or

$$C_{ds}=(2000)\frac{c_{sw}}{S_D}\quad \text{(English Units)}$$

where:

C_{ds} = particulate emission discharge, g/kg dry sludge (English units: lb/ton dry sludge).

10^{-3} = Metric conversion factor, g/mg.

2000 = English conversion factor, lb/ton.

5. On page 9320, under paragraph 9. *Calculation—Concentration of carbon monoxide,* in the second equation under "where" "$^{c}CO_{NIDR}$" should read "$^{c}CO_{NDIR}$".

6. In the third column on page 9321, in the ninth line from the bottom of paragraph two under "3.3.1 *Sodium thiosulfate solution, standard 0.1 N*", "thoisulfate" should read "thiosulfate".

7. In the third column on page 9322, paragraph "4.3.2" should be transferred to appear below paragraph "4.3.1".

8. In paragraph 5.2 on page 9322, the last word "sulution" should read "solution".

9. In the formula on page 9323, put a closed parenthesis after "m^{3}".

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Title 40—Protection of Environment

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

SUBCHAPTER C—AIR PROGRAMS

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Additions and Miscellaneous Amendments

Correction

In FR Doc. 74-4784 appearing at page 9307 as the Part II of the issue of Friday, March 8, 1974, and corrected on page 13776 in the issue of Wednesday, April 17, 1974, on page 13776, "paragraph c." should read as follows:

c. The formula in paragraph (d) should read as follows:

(d) Particulate emission rate shall be determined by:

$c_{aw}=c_s Q_s$ (Metric or English Units)

where:

c_{aw}=Particulate matter mass emissions, mg/hr (English units: lb/hr).

c_s=Particulate matter concentration, mg/m³ (English units: lb/dscf).

Q_s=Volumetric stack gas flow rate, dscm/hr (English units: dscf/hr). Q_s and c_s shall be determined using Methods 2 and 5, respectively.

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SUBCHAPTER C—AIR PROGRAMS

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Miscellaneous Amendments

On December 23, 1971 (36 FR 24876), pursuant to section 111 of the Clean Air Act, as amended, the Administrator promulgated subpart A, General Provisions, and subparts D, E, F, G, and H which set forth standards of performance for new and modified facilities within five categories of stationary sources: (1) Fossil fuel-fired steam generators, (2) incinerators, (3) portland cement plants, (4) nitric acid plants, and (5) sulfuric acid plants. Corrections to these standards were published on July 26, 1972 (37 FR 14877), and on May 23, 1973 (38 FR 13562). On October 15, 1973 (38 FR 28564), the Administrator amended subpart A, General Provisions, by adding provisions to regulate compliance with standards of performance during startup, shutdown, and malfunction. On March 8, 1974 (39 FR 9308), the Administrator promulgated Subparts I, J, K, L, M, N, and O which set forth standards of performance for new and modified facilities within seven categories of stationary sources: (1) Asphalt concrete plants, (2) petroleum refineries, (3) storage vessels for petroleum liquids, (4) secondary lead smelters, (5) brass and bronze ingot production plants, (6) iron and steel plants, and (7) sewage treatment plants. In the same publication, the Administrator also promulgated amendments to subpart A, General Provisions. Corrections to these standards were published on April 17, 1974 (39 FR 13776).

Subpart D, E, F, G, and H are revised below to be consistent with the October 15, 1973, and March 8, 1974, amendments to subpart A. At the same time, changes in wording are made to clarify the regulations. These amendments do not modify the control requirements of the standards of performance. Also, to be consistent with the Administrator's policy of converting to the metric system, the standards of performance and other numerical entries, which were originally expressed in English units, are converted to metric units. Some of the numerical entries are rounded after conversion to metric units. It should be noted that the numerical entries in the reference methods in the appendix will be changed to metric units at a later date.

The new source performance standards promulgated March 8, 1974, applicable to petroleum storage vessels, included within their coverage storage vessels in the 40,000 to 65,000 gallon size range. The preamble to that publication discussed the fact that vessels of that size had not been included in the proposed rule, and set forth the reasons for their subsequent inclusion. However, through oversight, nothing was set forth in the regulations or preamble prescribing the effective date of the standards as to vessels within the 40,000 to 65,000 gallon range.

Section 111(a)(2) of the Act specifies that only a source for which construction is commenced after the date on which a pertinent new source standard is prescribed is subject to the standard unless the source was covered by the standard as proposed. In this case, the date of prescription or promulgation of the standard is clearly the operative date since there was no proposal date. Accordingly, § 60.1 is amended below to conform to the language of section 111 (a)(2), and all persons are advised hereby that the provisions of Part 60

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promulgated March 8, 1974, apply to storage vessels for petroleum liquids in the 40,000 to 65,000 gallon size range for which construction is commenced on or after that date.

On March 8, 1974, § 60.7(d) was added to require owners and operators to retain all recorded information, including monitoring and performance testing measurements, required by the regulations for at least 2 years after the date on which the information was recorded. This requirement is therefore deleted from Subparts D, E, F, G, and H specific to each new source in this group to avoid repetition. On March 8, 1974, the definitions of "particulate matter" and "run" were added to § 60.2. Therefore the definition of "particular matter" is removed from Subparts D, E, F, G, and H, and the term "repetition," used in these subparts in sections pertinent to performance tests, is changed to "run."

On October 15, 1973, § 60.8(c) was revised to require that performance tests be conducted under conditions specified by the Administrator based on representative performance of the affected facility. For that reason, the sections in Subparts D, E, F, G, and H specifying operating conditions to be met during performance tests are deleted.

Sections 60.40, 60.41(b) and 60.42(a)(1) are revised to clarify that the performance standards for steam generators do not apply when an existing unit changes to accommodate the use of combustible materials other than fossil fuel as defined in § 60.41(b).

Sections 60.41(a) and 60.51(a) are revised to eliminate the requirement that a unit have a "primary" purpose. This change is intended to prevent circumvention of a standard by simply defining the primary purpose of a unit as something other than steam production or reducing the volume of solid waste.

In § 60.46, A.S.T.M. Methods D2015–66 (Reapproved 1972), D240–64 (Reapproved 1973), and D1826–64 (Reapproved 1970) are specified for measuring heating value. Prior to this issue no method was specified for determining heating value.

The phrase "maximum 2-hour average" in the standards of performance prescribed in §§ 60.42, 60.52, 60.62, 60.72, and 60.82 is deleted. Concurrently, in §§ 60.46, 60.54, 60.64, and 60.85 the sampling time requirements for particulate matter and acid mist are changed from a minimum of 2 hours to a minimum of 60 minutes per run. The phrase "maximum 2-hour average" is not consonant with § 60.8(f) which requires that compliance be determined by averaging the results of three runs. Results from performance tests conducted at power plants and other sources have not shown any decrease in the accuracy or precision of 1-hour samples as compared with 2-hour samples, and therefore the extra hour required to sample for 2 hours is not justified. The time interval between samples for sulfur dioxide and nitrogen oxides was originally established so that one run would be completed at approximately the same time as the particulate matter run. To maintain this relationship, the sampling intervals specified in §§ 60.46 and 60.74 are shortened to be consistent with the 60-minute-per-run requirement.

The requirement prescribed in §§ 60.46, 60.64, 60.74 and 60.85 for using "suitable flow meters" for measuring fuel and product flow rates is deleted. Such meters may be used if available, but other suitable methods of determining the flow rate of fuel or product during the test period may also be used.

A procedure specifying how to allow for carbon dioxide absorption in a wet scrubber and a formula for correcting particulate matter emissions to a basis of 12 percent CO_2 are added to § 60.54.

In anticipation of adding other appendices, the present appendix to Part 60 is being retitled "Appendix A—Reference Methods." The definitions of "reference method" and "particulate matter" are amended to be consistent with this change.

In the regulations in Subpart K setting forth the performance standard for storage vessels for petroleum liquids, the definition of "crude petroleum" was to have been changed to be consistent with the definition of "petroleum" in Subpart J. This change was inadvertently not made in 39 FR 9308 and thus §§ 60.110 and 60.111 are amended by replacing the term "crude petroleum" with "petroleum."

The remaining structural and wording changes are made for purposes of clarification.

On June 29, 1973, the U.S. Court of Appeals for the District of Columbia remanded to EPA for further consideration the new source performance standards for portland cement plants. Portland Cement Association v. Ruckelshaus, 486 F.2d 375. On September 10, 1973, the same Court remanded to EPA for further consideration the new source performance standards for sulfuric acid plants and coal-fired steam electric generators. Essex Chemical Co. v. Ruckelshaus, 486 F.2d 427. The Agency has not completed its consideration with respect to the remanded standards. These amendments are not intended to constitute a response to the remands. At the time the Agency completes its consideration with respect to the remanded standards, it will publicly announce its decision and at that time if any revisions of the standards are deemed necessary or desirable, will make such revisions.

These actions are effective on June 14, 1974. The Agency finds good cause exists for not publishing these actions as a notice of proposed rulemaking and for making them effective immediately upon publication for the following reasons:

1. These actions are intended for clarification and for maintaining consistency throughout the regulations. They are not intended to alter the substantive content of the regulations.

2. Immediate effectiveness of the actions enables the sources involved to proceed with certainty in conducting their affairs, and persons wishing to seek judicial review of the actions may do so without delay.

(42 U.S.C. 1857 (c) (6) and (9))

Dated: June 10, 1974.

JOHN QUARLES,
Acting Administrator.

Part 60 of Chapter I, Title 40 of the Code of Federal Regulations is amended as follows:

1. Section 60.1 is revised to read as follows:

§ 60.1 Applicability.

The provisions of this part apply to the owner or operator of any stationary source which contains an affected facility the construction or modification of which is commenced after the date of publication in this part of any standard (or, if earlier, the date of publication of any proposed standard) applicable to such facility.

2. Section 60.2 is amended by revising paragraphs (s) and (v) as follows:

§ 60.2 Definitions.

* * * * *

(s) "Reference method" means any method of sampling and analyzing for an air pollutant as described in Appendix A to this part.

* * * * *

(v) "Particulate matter" means any finely divided solid or liquid material, other than uncombined water, as measured by Method 5 of Appendix A to this part or an equivalent or alternative method.

* * * * *

3. Section 60.40 is revised to read as follows:

§ 60.40 Applicability and designation of affected facility.

The provisions of this subpart are applicable to each fossil fuel-fired steam generating unit of more than 63 million kcal per hour heat input (250 million Btu per hour), which is the affected facility. Any change to an existing fossil fuel-fired steam generating unit to accommodate the use of combustible materials, other than fossil fuels as defined in this subpart, shall not bring that unit under the applicability of this subpart.

4. Section 60.41 is amended by deleting "primary" in paragraph (a), revising paragraph (b), and deleting paragraph (c). As amended, § 60.41 reads as follows:

§ 60.41 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act, and in subpart A of this part.

(a) "Fossil fuel-fired steam generating unit" means a furnace or boiler used in the process of burning fossil fuel for the purpose of producing steam by heat transfer.

(b) "Fossil fuel" means natural gas, petroleum, coal, and any form of solid, liquid, or gaseous fuel derived from such materials for the purpose of creating useful heat.

5. Section 60.42 is revised to read as follows:

§ 60.42 Standard for particulate matter.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility any gases which:

(1) Contain particulate matter in excess of 0.18 g per million cal heat input (0.10 lb per million Btu) derived from fossil fuel.

(2) Exhibit greater than 20 percent opacity except that a maximum of 40 percent opacity shall be permissible for not more than 2 minutes in any hour. Where the presence of uncombined water is the only reason for failure to meet the requirements of this paragraph, such failure will not be a violation of this section.

6. Section 60.43 is revised to read as follows:

§ 60.43 Standard for sulfur dioxide.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility any gases which contain sulfur dioxide in excess of:

(1) 1.4 g per million cal heat input (0.80 lb per million Btu) derived from liquid fossil fuel.

(2) 2.2 g per million cal heat input (1.2 lb per million Btu) derived from solid fossil fuel.

(b) When different fossil fuels are burned simultaneously in any combination, the applicable standard shall be determined by proration using the following formula:

$$\frac{y(1.4)+z(2.2)}{y+z}$$

where:

y is the percentage of total heat input derived from liquid fossil fuel, and
z is the percentage of total heat input derived from solid fossil fuel.

(c) Compliance shall be based on the total heat input from all fossil fuels burned, including gaseous fuels.

7. Section 60.44 is revised to read as follows:

§ 60.44 Standard for nitrogen oxides.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility any gases which contain nitrogen oxides, expressed as NO_2 in excess of:

(1) 0.36 g per million cal heat input (0.20 lb per million Btu) derived from gaseous fossil fuel.

(2) 0.54 g per million cal heat input (0.30 lb per million Btu) derived from liquid fossil fuel.

(3) 1.26 g per million cal heat input (0.70 lb per million Btu) derived from solid fossil fuel (except lignite).

(b) When different fossil fuels are burned simultaneously in any combination, the applicable standard shall be determined by proration. Compliance shall be determined by using the following formula:

$$\frac{x(0.36)+y(0.54)+z(1.26)}{x+y+z}$$

where:

x is the percentage of total heat input derived from gaseous fossil fuel,
y is the percentage of total heat input derived from liquid fossil fuel, and
z is the percentage of total heat input derived from solid fossil fuel (except lignite).

§ 60.45 [Amended]

8. Section 60.45 is amended by deleting and reserving paragraph (f).

9. Section 60.46 is revised to read as follows:

§ 60.46 Test methods and procedures.

(a) The reference methods in Appendix A to this part, except as provided for in § 60.8(b), shall be used to determine compliance with the standards prescribed in §§ 60.42, 60.43, and 60.44 as follows:

(1) Method 1 for sample and velocity traverses;

(2) Method 2 for velocity and volumetric flow rate;

(3) Method 3 for gas analysis;

(4) Method 5 for the concentration of particulate matter and the associated moisture content;

(5) Method 6 for the concentration of SO_2; and

(6) Method 7 for the concentration of NO_x.

(b) For Method 5, the sampling time for each run shall be at least 60 minutes and the minimum sample volume shall be 0.85 dscm (30.0 dscf) except that smaller sampling times or sample volumes, when necessitated by process variables or other factors, may be approved by the Administrator.

(c) For Methods 6 and 7, the sampling site shall be the same as that for determining volumetric flow rate. The sampling point in the duct shall be at the centroid of the cross section or at a point no closer to the walls than 1 m (3.28 ft).

(d) For Method 6, the minimum sampling time shall be 20 minutes and the minimum sample volume shall be 0.02 dscm (0.71 dscf) except that smaller sampling times or sample volumes, when necessitated by process variables or other factors, may be approved by the Administrator. The sample shall be extracted at a rate proportional to the gas velocity at the sampling point. The arithmetic average of two samples shall constitute one run. Samples shall be taken at approximately 30-minute intervals.

(e) For Method 7, each run shall consist of at least four grab samples taken at approximately 15-minute intervals. The arithmetic mean of the samples shall constitute the run values.

(f) Heat input, expressed in cal per hr (Btu/hr), shall be determined during each testing period by multiplying the heating value of the fuel by the rate of fuel burned. Heating value shall be determined in accordance with A.S.T.M. Method D2015–66 (Reapproved 1972), D240–64 (Reapproved 1973), or D1826–64 (Reapproved 1970). The rate of fuel burned during each testing period shall be determined by suitable methods, and shall be confirmed by a material balance over the steam generation system.

(g) For each run, emissions expressed in g/million cal shall be determined by dividing the emission rate in g/hr by the heat input. The emission rate shall be determined by the equation g/hr = $Q_s \times c$ where Q_s = volumetric flow rate of the total effluent in dscm/hr as determined for each run in accordance with paragraph (a)(2) of this section.

(1) For particulate matter, c = particulate concentration in g/dscm, as determined in accordance with paragraph (a)(4) of this section.

(2) For SO_2, c = SO_2 concentration in g/dscm, as determined in accordance with paragraph (a)(5) of this section.

(3) For NO_x, c = NO_x concentration in g/dscm, as determined in accordance with paragraph (a)(6) of this section.

10. Section 60.50 is revised to read as follows:

§ 60.50 Applicability and designation of affected facility.

The provisions of this subpart are applicable to each incinerator of more than 45 metric tons per day charging rate (50 tons/day), which is the affected facility.

§ 60.51 [Amended]

11. Section 60.51 is amended by striking the word "primary" in paragraph (a) and by deleting paragraph (d).

12. Section 60.52 is revised to read as follows:

§ 60.52 Standard for particulate matter.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this part shall cause to be discharged into the atmosphere from any affected facility any gases which contain particulate matter in excess of 0.18 g/dscm (0.08 gr/dscf) corrected to 12 percent CO_2.

13. Section 60.53 is revised to read as follows:

§ 60.53 Monitoring of operations.

(a) The owner or operator of any incinerator subject to the provisions of this part shall record the daily charging rates and hours of operation.

14. Section 60.54 is revised to read as follows:

§ 60.54 Test methods and procedures.

(a) The reference methods in Appendix A to this part, except as provided for in § 60.8(b), shall be used to determine compliance with the standard prescribed in § 60.52 as follows:

(1) Method 5 for the concentration of particulate matter and the associated moisture content;

(2) Method 1 for sample and velocity traverses;

(3) Method 2 for velocity and volumetric flow rate; and

(4) Method 3 for gas analysis and calculation of excess air, using the integrated sample technique.

(b) For Method 5, the sampling time for each run shall be at least 60 minutes and the minimum sample volume shall be 0.85 dscm (30.0 dscf) except that smaller sampling times or sample volumes, when necessitated by process variables or other factors, may be approved by the Administrator.

(c) If a wet scrubber is used, the gas analysis sample shall reflect flue gas conditions after the scrubber, allowing for carbon dioxide absorption by sampling the gas on the scrubber inlet and outlet sides according to either the procedure under paragraphs (c)(1) through (c)(5) of this section or the procedure under paragraphs (c)(1), (c)(2) and (c)(6) of this section as follows:

(1) The outlet sampling site shall be the same as for the particulate matter measurement. The inlet site shall be selected according to Method 1, or as specified by the Administrator.

(2) Randomly select 9 sampling points within the cross-section at both the inlet and outlet sampling sites. Use the first set of three for the first run, the second set for the second run, and the third set for the third run.

(3) Simultaneously with each particulate matter run, extract and analyze for CO_2 an integrated gas sample according to Method 3, traversing the three sample points and sampling at each point for equal increments of time. Conduct the runs at both inlet and outlet sampling sites.

(4) Measure the volumetric flow rate at the inlet during each particulate matter run according to Method 2, using the full number of traverse points. For the inlet make two full velocity traverses approximately one hour apart during each run and average the results. The outlet volumetric flow rate may be determined from the particulate matter run (Method 5).

(5) Calculate the adjusted CO_2 percentage using the following equation:

$$(\%\ CO_2)_{adj} = (\%\ CO_2)_{di}\ (Q_{di}/Q_{do})$$

where:

$(\%\ CO_2)_{adj}$ is the adjusted CO_2 percentage which removes the effect of CO_2 absorption and dilution air,

$(\%\ CO_2)_{di}$ is the percentage of CO_2 measured before the scrubber, dry basis,

Q_{di} is the volumetric flow rate before the scrubber, average of two runs, dscf/min (using Method 2), and

Q_{do} is the volumetric flow rate after the scrubber, dscf/min (using Methods 2 and 5).

(6) Alternatively, the following procedures may be substituted for the procedures under paragraphs (c)(3), (4), and (5) of this section:

(i) Simultaneously with each particulate matter run, extract and analyse for CO_2, O_2, and N_2 an integrated gas sample according to Method 3, traversing the three sample points and sampling for equal increments of time at each point. Conduct the runs at both the inlet and outlet sampling sites.

(ii) After completing the analysis of the gas sample, calculate the percentage of excess air (% EA) for both the inlet and outlet sampling sites using equation 3–1 in Appendix A to this part.

(iii) Calculate the adjusted CO_2 percentage using the following equation:

$$(\%\ CO_2)_{adj} = (\%\ CO_2)_{di} \left[\frac{100+(\%\ EA)_i}{100+(\%\ EA)_o}\right]$$

where:

$(\%\ CO_2)_{adj}$ is the adjusted outlet CO_2 percentage,

$(\%\ CO_2)_{di}$ is the percentage of CO_2 measured before the scrubber, dry basis,

$(\%\ EA)_i$ is the percentage of excess air at the inlet, and

$(\%\ EA)_o$ is the percentage of excess air at the outlet.

(d) Particulate matter emissions, expressed in g/dscm, shall be corrected to 12 percent CO_2 by using the following formula:

$$c_{12} = \frac{12c}{\%\ CO_2}$$

where:

c_{12} is the concentration of particulate matter corrected to 12 percent CO_2,

c is the concentration of particulate matter as measured by Method 5, and

$\%\ CO_2$ is the percentage of CO_2 as measured by Method 3, or when applicable, the adjusted outlet CO_2 percentage as determined by paragraph (c) of this section.

§ 60.61 [Amended]

15. Section 60.61 is amended by deleting paragraph (b).

16. Section 60.62 is revised to read as follows:

§ 60.62 Standard for particulate matter.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any kiln any gases which:

(1) Contain particulate matter in excess of 0.15 kg per metric ton of feed (dry basis) to the kiln (0.30 lb per ton).

(2) Exhibit greater than 10 percent opacity.

(b) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any clinker cooler any gases which:

(1) Contain particulate matter in excess of 0.050 kg per metric ton of feed (dry basis) to the kiln (0.10 lb per ton).

(2) Exhibit 10 percent opacity, or greater.

(c) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility other than the kiln and clinker cooler any gases which exhibit 10 percent opacity, or greater.

(d) Where the presence of uncombined water is the only reason for failure to meet the requirements of paragraphs (a)(2), (b)(2), and (c), such failure will not be a violation of this section.

17. Section 60.63 is revised to read as follows:

§ 60.63 Monitoring of operations.

(a) The owner or operator of any portland cement plant subject to the provisions of this part shall record the daily production rates and kiln feed rates.

18. Section 60.64 is revised to read as follows:

§ 60.64 Test methods and procedures.

(a) The reference methods in Appendix A to this part, except as provided for in § 60.8(b), shall be used to determine compliance with the standards prescribed in § 60.62 as follows:

(1) Method 5 for the concentration of particulate matter and the associated moisture content;

(2) Method 1 for sample and velocity traverses;

(3) Method 2 for velocity and volumetric flow rate; and

(4) Method 3 for gas analysis.

(b) For Method 5, the minimum sampling time and minimum sample volume for each run, except when process variables or other factors justify otherwise to the satisfaction of the Administrator, shall be as follows:

(1) 60 minutes and 0.85 dscm (30.0 dscf) for the kiln.

(2) 60 minutes and 1.15 dscm (40.6 dscf) for the clinker cooler.

(c) Total kiln feed rate (except fuels), expressed in metric tons per hour on a dry basis, shall be determined during each testing period by suitable methods; and shall be confirmed by a material balance over the production system.

(d) For each run, particulate matter emissions, expressed in g/metric ton of kiln feed, shall be determined by dividing the emission rate in g/hr by the kiln feed rate. The emission rate shall be determined by the equation, $g/hr = Q_s \times c$, where Q_s = volumetric flow rate of the total effluent in dscm/hr as determined in accordance with paragraph (a)(3) of this section, and c = particulate concentration in g/dscm as determined in accordance with paragraph (a)(1) of this section.

19. Section 60.72 is revised to read as follows:

§ 60.72 Standard for nitrogen oxides.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility any gases which:

(1) Contain nitrogen oxides, expressed as NO_2, in excess of 1.5 kg per metric ton of acid produced (3.0 lb per ton), the production being expressed as 100 percent nitric acid.

(2) Exhibit 10 percent opacity, or greater. Where the presence of uncombined water is the only reason for failure to meet the requirements of this paragraph, such failure will not be a violation of this section.

§ 60.73 [Amended]

20. Section 60.73 is amended by deleting and reserving paragraph (d).

21. Section 60.74 is revised to read as follows:

§ 60.74 Test methods and procedures.

(a) The reference methods in Appendix A to this part, except as provided for in § 60.8(b), shall be used to determine compliance with the standard prescribed in § 60.72 as follows:

(1) Method 7 for the concentration of NO_2;

(2) Method 1 for sample and velocity traverses;

(3) Method 2 for velocity and volumetric flow rate; and

(4) Method 3 for gas analysis.

(b) For Method 7, the sample site shall be selected according to Method 1 and the sampling point shall be the centroid of the stack or duct or at a point no closer to the walls than 1 m (3.28 ft). Each run shall consist of at least four grab samples taken at approximately 15-minutes intervals. The arithmetic mean of the samples shall constitute the run value. A velocity traverse shall be performed once per run.

(c) Acid production rate, expressed in metric tons per hour of 100 percent nitric acid, shall be determined during each testing period by suitable methods and shall be confirmed by a material balance over the production system.

(d) For each run, nitrogen oxides, expressed in g/metric ton of 100 percent nitric acid, shall be determined by dividing the emission rate in g/hr by the acid production rate. The emission rate shall be determined by the equation,

$$g/hr = Q_s \times c$$

where Q_s = volumetric flow rate of the effluent in dscm/hr, as determined in accordance with paragraph (a)(3) of this section, and c = NO_2 concentration in g/dscm, as determined in accordance with paragraph (a)(1) of this section.

22. Section 60.81 is amended by revising paragraph (b) as follows:

§ 60.81 Definitions.

* * * * *

(b) "Acid mist" means sulfuric acid mist, as measured by Method 8 of Appendix A to this part or an equivalent or alternative method.

23. Section 60.82 is revised to read as follows:

§ 60.82 Standard for sulfur dioxide.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility any gases which contain sulfur dioxide in excess of 2 kg per metric ton of acid produced (4 lb per ton), the production being expressed as 100 percent H_2SO_4.

24. Section 60.83 is revised to read as follows:

§ 60.83 Standard for acid mist.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility any gases which:

(1) Contain acid mist, expressed as H_2SO_4, in excess of 0.075 kg per metric ton of acid produced (0.15 lb per ton), the production being expressed as 100 percent H_2SO_4.

(2) Exhibit 10 percent opacity, or greater. Where the presence of uncombined water is the only reason for failure to meet the requirements of this paragraph, such failure will not be a violation of this section.

§ 60.84 [Amended]

25. Section 60.84 is amended by deleting and reserving paragraph (d).

26. Section 60.85 is revised to read as follows:

§ 60.85 Test methods and procedures.

(a) The reference methods in Appendix A to this part, except as provided for in § 60.8(b), shall be used to determine compliance with the standards prescribed in §§ 60.82 and 60.83 as follows:

(1) Method 8 for the concentrations of SO_2 and acid mist;

(2) Method 1 for sample and velocity traverses;

(3) Method 2 for velocity and volumetric flow rate; and

(4) Method 3 for gas analysis.

(b) The moisture content can be considered to be zero. For Method 8 the sampling time for each run shall be at least 60 minutes and the minimum sample volume shall be 1.15 dscm (40.6 dscf) except that smaller sampling times or sample volumes, when necessitated by process variables or other factors, may be approved by the Administrator.

(c) Acid production rate, expressed in metric tons per hour of 100 percent H_2SO_4, shall be determined during each testing period by suitable methods and shall be confirmed by a material balance over the production system.

(d) Acid mist and sulfur dioxide emissions, expressed in g/metric ton of 100 percent H_2SO_4, shall be determined by dividing the emission rate in g/hr by the acid production rate. The emission rate shall be determined by the equation, $g/hr = Q_s \times c$, where Q_s = volumetric flow rate of the effluent in dscm/hr as determined in accordance with paragraph (a)(3) of this section, and c = acid mist and SO_2 concentrations in g/dscm as determined in accordance with paragraph (a)(1) of this section.

§ 60.110 [Amended]

27. Section 60.110(b) is amended by striking the words "the crude."

28. In § 60.111, paragraphs (b), (d), (g), and (h) are revised.

As amended § 60.111 reads as follows:

§ 60.111 Definitions.

* * * * *

(b) "Petroleum liquids" means petroleum, condensate, and any finished or intermediate products manufactured in a petroleum refinery but does not mean Number 2 through Number 6 fuel oils as specified in A.S.T.M. D396–69, gas turbine fuel oils Numbers 2–GT through 4–GT as specified in A.S.T.M. D2880–71, or diesel fuel oils Numbers 2–D and 4–D as specified in A.S.T.M. D975–68.

* * * * *

(d) "Petroleum" means the crude oil removed from the earth and the oils derived from tar sands, shale, and coal.

* * * * *

(g) "Custody transfer" means the transfer of produced petroleum and/or condensate, after processing and/or treating in the producing operations, from storage tanks or automatic transfer facilities to pipelines or any other forms of transportation.

(h) "Drilling and production facility" means all drilling and servicing equipment, wells, flow lines, separators, equipment, gathering lines, and auxiliary nontransportation-related equipment used in the production of petroleum but does not include natural gasoline plants.

* * * * *

29. The appendix to Part 60 titled "Appendix—Test Methods" is retitled "Appendix A—Reference Methods."

[FR Doc.74–13633 Filed 6–13–74;8:45 am]

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Title 40—Protection of the Environment

[FRL [illegible]]

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

SUBCHAPTER C—AIR PROGRAMS

PART 52—APPROVAL AND PROMULGATION OF IMPLEMENTATION PLANS

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

PART 61—NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS

Region V Office: New Address

The Region V Office of EPA has been relocated. The new address is: EPA, Region V, Federal Building, 230 South Dearborn, Chicago, Illinois 60604. This change revises Region V's office address appearing in §§ 52.16, 60.4 and 61.04 of Title 40, Code of Federal Regulations.

Dated: October 21, 1974.

ROGER STRELOW,
Assistant Administrator for Air and Waste Management.

Parts 52, 60 and 61, Chapter I, Title 40 of the Code of Federal Regulations are amended as follows:

§§ 52.16, 60.4, 61.04 [Amended]

1. The address of the Region V office is revised to read:

Region V (Illinois, Indiana, Minnesota, Ohio, Wisconsin) Federal Building, 230 South Dearborn, Chicago, Illinois 60606.

[FR Doc.74-24819 Filed 10-24-74;8:45 am]

FEDERAL REGISTER, VOL. 39, NO. 208—FRIDAY, OCTOBER 25, 1974

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Title 40—Protection of the Environment

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

SUBCHAPTER C—AIR PROGRAMS

[FRL 291-6]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Opacity Provisions

On June 29, 1973, the United States Court of Appeals for the District of Columbia in "Portland Cement Association v. Ruckelshaus," 486 F. 2d 375 (1973) remanded to EPA the standard of performance for Portland cement plants (40 CFR 60.60 et seq.) promulgated by EPA under section 111 of the Clean Air Act. In the remand, the Court directed EPA to reconsider among other things the use of the opacity standards. EPA has prepared a response to the remand. Copies of this response are available from the Emission Standards and Engineering Division, Environmental Protection Agency, Research Triangle Park, N.C. 27711, Attn: Mr. Don R. Goodwin. In developing the response, EPA collected and evaluated a substantial amount of information which is summarized and referenced in the response. Copies of this information are available for inspection during normal office hours at EPA's Office of Public Affairs, 401 M Street SW., Washington, D.C. EPA determined that the Portland cement plant standards generally did not require revision but did not find that certain revisions are appropriate to the opacity provisions of the standards. The provisions promulgated herein include a revision to § 60.11, Compliance with Standards and Maintenance Requirements, a revision to the opacity standard for Portland cement plants, and revisions to Reference Method 9. The bases for the revisions are discussed in detail in the Agency's response to the remand. They are summarized below.

The revisions to § 60.11 include the modification of paragraph (b) and the addition of paragraph (e). Paragraph (b) has been revised to indicate that while Reference Method 9 remains the primary and accepted means for determining compliance with opacity standards in this part, EPA will accept as probative evidence in certain situations and under certain conditions the results of continuous monitoring by transmissometer to determine whether a violation has in fact occurred. The revision makes clear that even in such situations the results of opacity readings by Method 9 remain presumptively valid and correct.

The provisions in paragraph (e) provide a mechanism for an owner or operator to petition the Administrator to establish an opacity standard for an affected facility where such facility meets all applicable standards for which a performance test is conducted under § 60.8 but fails to meet an applicable opacity standard. This provision is intended primarily to apply to cases where a source installs a very large diameter stack which causes the opacity of the emissions to be

FEDERAL REGISTER, VOL. 39, NO. 219—TUESDAY, NOVEMBER 12, 1974 greater than if a stack of the diameter ordinarily used in the industry were installed. Although this situation is considered to be very unlikely to occur, this provision will accommodate such a situation. The provision could also apply to other situations where for any reason an affected facility could fail to meet opacity standards while meeting mass emission standards, although no such situations are expected to occur.

A revision to the opacity standard for Portland cement plants is promulgated herein. The revision changes the opacity limit for kilns from 10 percent to 20 percent. This revision is based on EPA's policy on opacity standards and the new emission data from Portland cement plants evaluated by EPA during its reconsideration. The preamble to the standards of performance which were promulgated on March 8, 1974 (39 FR 9308) sets forth EPA's policy on opacity standards: (1) Opacity limits are independent enforceable standards; (2) where opacity and mass/concentration standards are applicable to the same source, the mass/concentration standards are established at a level which will result in the design, installation, and operation of the best adequately demonstrated system of emission reduction (taking costs into account); and (3) the opacity standards are established at a level which will require proper operation and maintenance of such control systems. The new data indicate that increasing the opacity limits for kilns from 10 percent to 20 percent is justified, because such a standard will still require the design, installation, and operation of the best adequately demonstrated system of emission reduction (taking costs into account) while eliminating or minimizing the situations where it will be necessary to promulgate a new opacity standard under § 60.11(e).

In evaluating the accuracy of results from qualified observers following the procedures of Reference Method 9, EPA determined that some revisions to Reference Method 9 are consistently able to evaluation showed that observers trained and certified in accordance with the procedures prescribed under Reference Method 9 are consistently able to read opacity with errors not exceeding ± 7.5 percent based upon single sets of the average of 24 readings. The revisions to Reference Method 9 include the following:

1. An introductory section is added. This includes a discussion of the concept of visible emission reading and describes the effect of variable viewing conditions. Information is also presented concerning the accuracy of the method noting that the accuracy of the method must be taken into account when determining possible violations of applicable opacity standards.

2. Provisions are added which specify that the determination of opacity requires averaging 24 readings taken at 15-second intervals. The purpose for taking 24 readings is both to extend the averaging time over which the observations are made, and to take sufficient readings to insure acceptable accuracy.

3. More specific criteria concerning observer position with respect to the sun are added. Specifically, the sun must be within a 140° sector to the observer's back.

4. Criteria concerning an observer's position with respect to the plume are added. Specific guidance is also provided for reading emissions from rectangular emission points with large length to width ratios, and for reading emissions from multiple stacks. In each of these cases, emissions are to be read across the shortest path length.

5. Provisions are added to make clear that opacity of contaminated water or steam plumes is to be read at a point where water does not exist in condensed form. Two specific instructions are provided: One for the case where opacity can be observed prior to the formation of the condensed water plume, and one for the case where opacity is to be observed after the condensed water plume has dissipated.

6. Specifications are added for the smoke generator used for qualification of observers so that State or local air pollution control agencies may provide observer qualification training consistent with EPA training.

In developing this regulation we have taken into account the comments received in response to the September 11, 1974 (39 FR 35852) notice of proposed rulemaking which proposed among other things certain minor changes to Reference Method 9. This regulation represents the rulemaking with respect to the revisions to Method 9.

The determination of compliance with applicable opacity standards will be based on an average of 24 consecutive opacity readings taken at 15 second intervals. This approach is a satisfactory means of enforcing opacity standards in cases where the violation is a continuing one and time exceptions are not part of the applicable opacity standard. However, the opacity standards for steam electric generators in 40 CFR 60.42 and fluid catalytic cracking unit catalyst regenerators in 40 CFR 60.102 and numerous opacity standards in State implementation plans specify various time exceptions. Many State and local air pollution control agencies use a different approach in enforcing opacity standards than the six-minute average period specified in this revision to Method 9. EPA recognizes that certain types of opacity violations that are intermittent in nature require a different approach in applying the opacity standards than this revision to Method 9. It is EPA's intent to propose an additional revision to Method 9 specifying an alternative method to enforce opacity standards. It is our intent that this method specify a minimum number of readings that must be taken, such as a minimum of ten readings above the standard in any one hour period prior to citing a violation. EPA is in the process of analyzing available data and determining the error involved in reading opacity in this manner and will propose this revision to Method 9 as soon as this analysis is completed. The Agency solicits comments and recommendations on the need for this additional revision to Method 9 and would welcome any suggestions particularly from air pollution control agencies on how we might make Method 9 more responsive to the needs of these agencies.

These actions are effective on November 12, 1974. The Agency finds good cause exists for not publishing these actions as a notice of proposed rulemaking and for making them effective immediately upon publication for the following reasons:

(1) Only minor amendments are being made to the opacity standards which were remanded.

(2) The U.S. Court of Appeals for the District of Columbia instructed EPA to complete the remand proceeding with respect to the Portland cement plant standards by November 5, 1974.

(3) Because opacity standards are the subject of other litigation, it is necessary to reach a final determination with respect to the basic issues involving opacity at this time in order to properly respond to this issue with respect to such other litigation.

These regulations are issued under the authority of sections 111 and 114 of the Clean Air Act, as amended (42 U.S.C. 1857c–6 and 9).

Dated: November 1, 1974.

JOHN QUARLES,
Acting Administrator.

Part 60 of Chapter I, Title 40 of the Code of Federal Regulations is amended as follows:

1. Section 60.11 is amended by revising paragraph (b) and adding paragraph (e), reading as follows:

§ 60.11 Compliance with standards and maintenance requirements.

* * * * *

(b) Compliance with opacity standards in this part shall be determined by conducting observations in accordance with Reference Method 9 in Appendix A of this part. Opacity readings of portions of plumes which contain condensed, uncombined water vapor shall not be used for purposes of determining compliance with opacity standards. The results of continuous monitoring by transmissometer which indicate that the opacity at the time visual observations were made was not in excess of the standard are probative but not conclusive evidence of the actual opacity of an emission, provided that the source shall meet the burden of proving that the instrument used meets (at the time of the alleged violation) Performance Specification 1 in Appendix B of this part, has been properly maintained and (at the time of the alleged violation) calibrated, and that the resulting data have not been tampered with in any way.

* * * * *

(e)(1) An owner or operator of an affected facility may request the Administrator to determine opacity of emissions from the affected facility during the initial performance tests required by § 60.8.

(2) Upon receipt from such owner or operator of the written report of the results of the performance tests required by § 60.8, the Administrator will make a finding concerning compliance with opacity and other applicable standards. If the Administrator finds that an affected facility is in compliance with all applicable standards for which performance tests are conducted in accordance with § 60.8 of this part but during the time such performance tests are being conducted fails to meet any applicable opacity standard, he shall notify the owner or operator and advise him that he may petition the Administrator within 10 days of receipt of notification to make appropriate adjustment to the opacity standard for the affected facility.

(3) The Administrator will grant such a petition upon a demonstration by the owner or operator that the affected facility and associated air pollution control equipment was operated and maintained in a manner to minimize the opacity of emissions during the performance tests; that the performance tests were performed under the conditions established by the Administrator; and that the affected facility and associated air pollution control equipment were incapable of being adjusted or operated to meet the applicable opacity standard.

(4) The Administrator will establish an opacity standard for the affected facility meeting the above requirements at a level at which the source will be able, as indicated by the performance and opacity tests, to meet the opacity standard at all times during which the source is meeting the mass or concentration emission standard. The Administrator will promulgate the new opacity standard in the Federal Register.

2. In § 60.62, paragraph (a)(2) is revised to read as follows:

§ 60.62 Standard for particulate matter.

(a) * * *

(2) Exhibit greater than 20 percent opacity.

* * * * *

3. Appendix A—Reference Methods is amended by revising Reference Method 9 as follows:

APPENDIX A—REFERENCE METHODS

* * * * *

METHOD 9—VISUAL DETERMINATION OF THE OPACITY OF EMISSIONS FROM STATIONARY SOURCES

Many stationary sources discharge visible emissions into the atmosphere; these emissions are usually in the shape of a plume. This method involves the determination of plume opacity by qualified observers. The method includes procedures for the training and certification of observers, and procedures to be used in the field for determination of plume opacity. The appearance of a plume as viewed by an observer depends upon a number of variables, some of which may be controllable and some of which may not be controllable in the field. Variables which can be controlled to an extent to which they no longer exert a significant influence upon plume appearance include: Angle of the observer with respect to the plume; angle of the observer with respect to the sun; point of observation of attached and detached steam plume; and angle of the observer with respect to a plume emitted from a rectangular stack with a large length to width ratio. The method includes specific criteria applicable to these variables.

Other variables which may not be controllable in the field are luminescence and color contrast between the plume and the background against which the plume is viewed. These variables exert an influence upon the appearance of a plume as viewed by an observer, and can affect the ability of the observer to accurately assign opacity values to the observed plume. Studies of the theory of plume opacity and field studies have demonstrated that a plume is most visible and presents the greatest apparent opacity when viewed against a contrasting background. It follows from this, and is confirmed by field trials, that the opacity of a plume, viewed under conditions where a contrasting background is present can be assigned with the greatest degree of accuracy. However, the potential for a positive error is also the greatest when a plume is viewed under such contrasting conditions. Under conditions presenting a less contrasting background, the apparent opacity of a plume is less and approaches zero as the color and luminescence contrast decrease toward zero. As a result, significant negative bias and negative errors can be made when a plume is viewed under less contrasting conditions. A negative bias decreases rather than increases the possibility that a plant operator will be cited for a violation of opacity standards due to observer error.

Studies have been undertaken to determine the magnitude of positive errors which can be made by qualified observers while reading plumes under contrasting conditions and using the procedures set forth in this method. The results of these studies (field trials) which involve a total of 769 sets of 25 readings each are as follows:

(1) For black plumes (133 sets at a smoke generator), 100 percent of the sets were read with a positive error[1] of less than 7.5 percent opacity; 99 percent were read with a positive error of less than 5 percent opacity.

(2) For white plumes (170 sets at a smoke generator, 168 sets at a coal-fired power plant, 298 sets at a sulfuric acid plant), 99 percent of the sets were read with a positive error of less than 7.5 percent opacity; 95 percent were read with a positive error of less than 5 percent opacity.

The positive observational error associated with an average of twenty-five readings is therefore established. The accuracy of the method must be taken into account when determining possible violations of applicable opacity standards.

1. *Principle and applicability.*

1.1 Principle. The opacity of emissions from stationary sources is determined visually by a qualified observer.

1.2 Applicability. This method is applicable for the determination of the opacity of emissions from stationary sources pursuant to § 60.11(b) and for qualifying observers for visually determining opacity of emissions.

2. *Procedures.* The observer qualified in accordance with paragraph 3 of this method shall use the following procedures for visually determining the opacity of emissions:

2.1 Position. The qualified observer shall stand at a distance sufficient to provide a clear view of the emissions with the sun oriented in the 140° sector to his back. Consistent with maintaining the above requirement, the observer shall, as much as possible, make his observations from a position such that his line of vision is approximately perpendicular to the plume direction, and when observing opacity of emissions from rectangular outlets (e.g. roof monitors, open baghouses, noncircular stacks), approximately perpendicular to the longer axis of the outlet. The observer's line of sight should not include more than one plume at a time when multiple stacks are involved, and in any case the observer should make his observations with his line of sight perpendicular to the longer axis of such a set of multiple stacks (e.g. stub stacks on baghouses).

2.2 Field records. The observer shall record the name of the plant, emission location, type facility, observer's name and affiliation, and the date on a field data sheet (Figure 9–1). The time, estimated distance to the emission location, approximate wind direction, estimated wind speed, description of the sky condition (presence and color of clouds), and plume background are recorded on a field data sheet at the time opacity readings are initiated and completed.

2.3 Observations. Opacity observations shall be made at the point of greatest opacity in that portion of the plume where condensed water vapor is not present. The observer shall not look continuously at the plume, but instead shall observe the plume momentarily at 15-second intervals.

2.3.1 Attached steam plumes. When condensed water vapor is present within the plume as it emerges from the emission outlet, opacity observations shall be made beyond the point in the plume at which condensed water vapor is no longer visible. The observer shall record the approximate distance from the emission outlet to the point in the plume at which the observations are made.

2.3.2 Detached steam plume. When water vapor in the plume condenses and becomes visible at a distinct distance from the emission outlet, the opacity of emissions should be evaluated at the emission outlet prior to the condensation of water vapor and the formation of the steam plume.

2.4 Recording observations. Opacity observations shall be recorded to the nearest 5 percent at 15-second intervals on an observational record sheet. (See Figure 9–2 for an example.) A minimum of 24 observations shall be recorded. Each momentary observation recorded shall be deemed to represent the average opacity of emissions for a 15-second period.

2.5 Data Reduction. Opacity shall be determined as an average of 24 consecutive observations recorded at 15-second intervals. Divide the observations recorded on the record sheet into sets of 24 consecutive observations. A set is composed of any 24 consecutive observations. Sets need not be consecutive in time and in no case shall two sets overlap. For each set of 24 observations, calculate the average by summing the opacity of the 24 observations and dividing this sum by 24. If an applicable standard specifies an averaging time requiring more than 24 observations, calculate the average for all observations made during the specified time period. Record the average opacity on a record sheet. (See Figure 9–1 for an example.)

3. *Qualifications and testing.*

3.1 Certification requirements. To receive certification as a qualified observer, a candidate must be tested and demonstrate the ability to assign opacity readings in 5 percent increments to 25 different black plumes and 25 different white plumes, with an error not to exceed 15 percent opacity on any one reading and an average error not to exceed 7.5 percent opacity in each category. Candidates shall be tested according to the procedures described in paragraph 3.2. Smoke generators used pursuant to paragraph 3.2 shall be equipped with a smoke meter which meets the requirements of paragraph 3.3.

---

[1] For a set, positive error = average opacity determined by observers' 25 observations — average opacity determined from transmissometer's 25 recordings.

The certification shall be valid for a period of 6 months, at which time the qualification procedure must be repeated by any observer in order to retain certification.

3.2 Certification procedure. The certification test consists of showing the candidate a complete run of 50 plumes—25 black plumes and 25 white plumes—generated by a smoke generator. Plumes within each set of 25 black and 25 white runs shall be presented in random order. The candidate assigns an opacity value to each plume and records his observation on a suitable form. At the completion of each run of 50 readings, the score of the candidate is determined. If a candidate fails to qualify, the complete run of 50 readings must be repeated in any retest. The smoke test may be administered as part of a smoke school or training program, and may be preceded by training or familiarization runs of the smoke generator during which candidates are shown black and white plumes of known opacity.

3.3 Smoke generator specifications. Any smoke generator used for the purposes of paragraph 3.2 shall be equipped with a smoke meter installed to measure opacity across the diameter of the smoke generator stack. The smoke meter output shall display in-stack opacity based upon a pathlength equal to the stack exit diameter, on a full 0 to 100 percent chart recorder scale. The smoke meter optical design and performance shall meet the specifications shown in Table 9-1. The smoke meter shall be calibrated as prescribed in paragraph 3.3.1 prior to the conduct of each smoke reading test. At the completion of each test, the zero and span drift shall be checked and if the drift exceeds ±1 percent opacity, the condition shall be corrected prior to conducting any subsequent test runs. The smoke meter shall be demonstrated, at the time of installation, to meet the specifications listed in Table 9-1. This demonstration shall be repeated following any subsequent repair or replacement of the photocell or associated electronic circuitry including the chart recorder or output meter, or every 6 months, whichever occurs first.

TABLE 9-1—SMOKE METER DESIGN AND PERFORMANCE SPECIFICATIONS

Parameter:	*Specification*
a. Light source	Incandescent lamp operated at nominal rated voltage.
b. Spectral response of photocell.	Photopic (daylight spectral response of the human eye—reference 4.3).
c. Angle of view	15° maximum total angle.
d. Angle of projection.	15° maximum total angle.
e. Calibration error.	±3% opacity, maximum.
f. Zero and span drift.	±1% opacity, 30 minutes.
g. Response time	≤5 seconds.

3.3.1 Calibration. The smoke meter is calibrated after allowing a minimum of 30 minutes warmup by alternately producing simulated opacity of 0 percent and 100 percent. When stable response at 0 percent or 100 percent is noted, the smoke meter is adjusted to produce an output of 0 percent or 100 percent, as appropriate. This calibration shall be repeated until stable 0 percent and 100 percent readings are produced without adjustment. Simulated 0 percent and 100 percent opacity values may be produced by alternately switching the power to the light source on and off while the smoke generator is not producing smoke.

3.3.2 Smoke meter evaluation. The smoke meter design and performance are to be evaluated as follows:

3.3.2.1 Light source. Verify from manufacturer's data and from voltage measurements made at the lamp, as installed, that the lamp is operated within ±5 percent of the nominal rated voltage.

3.3.2.2 Spectral response of photocell. Verify from manufacturer's data that the photocell has a photopic response; i.e., the spectral sensitivity of the cell shall closely approximate the standard spectral-luminosity curve for photopic vision which is referenced in (b) of Table 9-1.

3.3.2.3 Angle of view. Check construction geometry to ensure that the total angle of view of the smoke plume, as seen by the photocell, does not exceed 15°. The total angle of view may be calculated from: $\theta = 2 \tan^{-1} d/2L$, where θ=total angle of view; d=the sum of the photocell diameter+the diameter of the limiting aperture; and L=the distance from the photocell to the limiting aperture. The limiting aperture is the point in the path between the photocell and the smoke plume where the angle of view is most restricted. In smoke generator smoke meters this is normally an orifice plate.

3.3.2.4 Angle of projection. Check construction geometry to ensure that the total angle of projection of the lamp on the smoke plume does not exceed 15°. The total angle of projection may be calculated from: $\theta = 2 \tan^{-1} d/2L$, where θ= total angle of projection; d= the sum of the length of the lamp filament + the diameter of the limiting aperture; and L= the distance from the lamp to the limiting aperture.

3.3.2.5 Calibration error. Using neutral-density filters of known opacity, check the error between the actual response and the theoretical linear response of the smoke meter. This check is accomplished by first calibrating the smoke meter according to 3.3.1 and then inserting a series of three neutral-density filters of nominal opacity of 20, 50, and 75 percent in the smoke meter pathlength. Filters calibarted within ±2 percent shall be used. Care should be taken when inserting the filters to prevent stray light from affecting the meter. Make a total of five nonconsecutive readings for each filter. The maximum error on any one reading shall be 3 percent opacity.

3.3.2.6 Zero and span drift. Determine the zero and span drift by calibrating and operating the smoke generator in a normal manner over a 1-hour period. The drift is measured by checking the zero and span at the end of this period.

3.3.2.7 Response time. Determine the response time by producng the series of five simulated 0 percent and 100 percent opacity values and observing the time required to reach stable response. Opacity values of 0 percent and 100 percent may be simulated by alternately switching the power to the light source off and on while the smoke generator is not operating.

4. *References.*

4.1 Air Pollution Control District Rules and Regulations, Los Angeles County Air Pollution Control District, Regulation IV, Prohibitions, Rule 50.

4.2 Weisburd, Melvin I., Field Operations and Enforcement Manual for Air, U.S. Environmental Protection Agency, Research Triangle Park, N.C., APTD-1100, August 1972. pp. 4.1-4.36.

4.3 Condon, E. U., and Odishaw, H., Handbook of Physics, McGraw-Hill Co., N.Y., N.Y., 1958, Table 3.1, p. 6-52.

FIGURE 9-1
RECORD OF VISUAL DETERMINATION OF OPACITY

PAGE___of___

COMPANY________________
LOCATION________________
TEST NUMBER________________
DATE________________
TYPE FACILITY________________
CONTROL DEVICE________________

HOURS OF OBSERVATION________________
OBSERVER________________
OBSERVER CERTIFICATION DATE________________
OBSERVER AFFILIATION________________
POINT OF EMISSIONS________________
HEIGHT OF DISCHARGE POINT________________

21

	Initial			Final
CLOCK TIME				
OBSERVER LOCATION Distance to Discharge				
Direction from Discharge				
Height of Observation Point				
BACKGROUND DESCRIPTION				
WEATHER CONDITIONS Wind Direction				
Wind Speed				
Ambient Temperature				
SKY CONDITIONS (clear, overcast, % clouds, etc.)				
PLUME DESCRIPTION Color				
Distance Visible				
OTHER INFORMATION				

SUMMARY OF AVERAGE OPACITY

Set Number	Time	Opacity	
	Start--End	Sum	Average

Readings ranged from ____ to ____ % opacity

The source was/was not in compliance with ____ at the time evaluation was made.

FIGURE 9-2 OBSERVATION RECORD PAGE ___ OF ___

COMPANY ______________
LOCATION ______________
TEST NUMBER ______________
DATE ______________

OBSERVER ______________
TYPE FACILITY ______________
POINT OF EMISSIONS ______________

Hr.	Min.	Seconds				STEAM PLUME (check if applicable)		COMMENTS
		0	15	30	45	Attached	Detached	
	0							
	1							
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
	11							
	12							
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	20							
	21							
	22							
	23							
	24							
	25							
	26							
	27							
	28							
	29							

FIGURE 9-2 OBSERVATION RECORD PAGE ___ OF ___
(Continued)

COMPANY ______________
LOCATION ______________
TEST NUMBER ______________
DATE ______________

OBSERVER ______________
TYPE FACILITY ______________
POINT OF EMISSIONS ______________

Hr.	Min.	Seconds				STEAM PLUME (check if applicable)		COMMENTS
		0	15	30	45	Attached	Detached	
	30							
	31							
	32							
	33							
	34							
	35							
	36							
	37							
	38							
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[FR Doc.74-26150 Filed 11-11-74;8:45 am]

11

[FRL 306-3]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Coal Refuse

On December 23, 1971 (36 FR 24876), pursuant to section 111 of the Clean Air Act, as amended, the Administrator promulgated standards of performance for nitrogen oxides emissions from fossil fuel-fired steam generators of more than 63 million kcal per hour (250 million Btu per hour) heat input. The purpose of this amendment is to clarify the applicability of § 60.44 with regard to units burning significant amounts of coal refuse.

Coal refuse is the low-heat value, low-volatile, high-ash content waste separated from coal, usually at the mine site. It can prevent restoration of the land and produce acid water runoff. The low-heat value, high-ash characteristics of coal refuse preclude combustion except in cyclone furnaces with current technology, which because of the furnace design emit nitrogen oxides (NO_x) in quantities greater than that permitted by the standard of performance. Preliminary test results on an experimental unit and emission factor calculations indicate that NO_x emissions would be two to three times the standard of 1.26 g per million cal heat input (0.7 pound per million Btu). At the time of promulgation of § 60.44 in 1971, EPA was unaware of the possibility of burning coal refuse in combination with other fossil-fuels, and thus the standards of performance were not designed to apply to coal refuse combustion. However, since coal refuse is a fossil fuel, as defined under § 60.41(b), its combustion is included under the present standards of performance.

Upon learning of the possible problem of coal refuse combustion units meeting the standard of performance for NOx, the Agency investigated emission data, combustion characteristics of the material, and the possibility of burning it in other than cyclone furnaces before consideration was given to revising the standards of performance. The investigation indicated no reason to exempt coal refuse-fired units from the particulate matter or sulfur dioxide standards of performance, since achievement of these standards is not entirely dependent on furnace design. However, the investigation convinced the Agency that with current technology it is not possible to burn significant amounts of coal refuse and achieve the NOx standard of performance.

Combustion of coal refuse piles would reduce the volume of a solid waste that adversely affects the environment, would decrease the quantity of coal that needs to be mined, and would reduce acid water drainage as the piles are consumed. While NOx emissions from coal refuse-fired cyclone boilers are expected to be up to three times the standard of performance, the predicted maximum ground-level concentration increase for the only currently planned coal refuse-fired unit (173 MW) is only two micrograms NOx per cubic meter. This predicted increase would raise the total ground-level concentration around this source to only five micrograms NOx per cubic meter, which is well below the national ambient standard. For these reasons, § 60.44 is being amended to exempt steam generating units burning at least 25 percent (by weight) coal refuse from the NOx standard of performance. Such units must comply with the sulfur dioxide and particulate matter standards of performance.

Since this amendment is a clarification of the existing standard of performance and is expected to only apply to one source, no formal impact statement is required for this rulemaking, pursuant to section 1(b) of the "Procedures for the Voluntary Preparation of Environmental Impact Statements" (39 FR 37419).

This action is effective on January 18, 1975. The Agency finds good cause exists for not publishing this action as a notice of proposed rulemaking and for making it effective immediately upon publication because:

1. The action is a clarification of an existing regulation and is not intended to alter the overall substantive content of that regulation.
2. The action will affect only one planned source and is not ever expected to have wide applicability.
3. Immediate effectiveness of the action enables the source involved to proceed with certainty in conducting its affairs.

(42 U.S.C. 1847c-6, 9)

Dated: January 8, 1975.

JOHN QUARLES,
Acting Administrator.

Part 60 of Chapter I, Title 40 of the Code of Federal Regulations is amended as follows:

1. Section 60.41 is amended by adding paragraph (c) as follows:

60.41 Definitions.

* * * * *

(c) "Coal refuse" means waste-products of coal mining, cleaning, and coal preparation operations (e.g. culm, gob, etc.) containing coal, matrix material, clay, and other organic and inorganic material.

2. Section 60.44 is amended by revising paragraphs (a) (3) and (b) as follows:

60.44 Standard for nitrogen oxides.

(a) * * *

(3) 1.26 g per million cal heat input (0.70 pound per million Btu) derived from solid fossil fuel (except lignite or a solid fossil fuel containing 25 percent, by weight, or more of coal refuse).

(b) When different fossil fuels are burned simultaneously in any combination, the applicable standard shall be determined by proration using the following formula:

$$\frac{x\ (0.36)+y\ (0.54)+z\ (1.26)}{x+y+z}$$

where:

x is the percentage of total heat input derived from gaseous fossil fuel,
y is the percentage of total heat input derived from liquid fossil fuel, and
z is the percentage of total heat input derived from solid fossil fuel (except lignite or a solid fossil fuel containing 25 percent, by wuight, or more of coal refuse).

When lignite or a solid fossil fuel containing 25 percent by weight, or more of coal refuse is burned in combination with gaseous, liquid or other solid fossil fuel, the standard for nitrogen oxides does not apply.

[FR Doc.75-1544 Filed 1-15-75;8:45 am]

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[FRL 364-7]

SUBCHAPTER C—AIR PROGRAMS

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Delegation of Authority to State of Washington

Pursuant to the delegation of authority for the standards of performance for new stationary sources (NSPS) to the State of Washington on February 28, 1975, EPA is today amending 40 CFR 60.4 *Address*. A notice announcing this delegation was published on April 1, 1975 (40 FR 14632). The amended § 60.4 is set forth below.

The Administrator finds good cause for making this rulemaking effective immediately as the change is an administrative change and not one of substantive content. It imposes no additional substantive burdens on the parties affected.

This rulemaking is effective immediately, and is issued under the authority of section 111 of the Clean Air Act, as amended. 42 U.S.C. 1857c–6.

Dated: April 2, 1975.

ROGER STRELOW,
Assistant Administrator for
Air and Waste Management.

Part 60 of Chapter I, Title 40 of the Code of Federal Regulations is amended as follows:

Subpart A—General Provisions

1. Section 60.4 is revised to read as follows:

§ 60.4 Address.

(a) All requests, reports, applications, submittals, and other communications to the Administrator pursuant to this part shall be submitted in duplicate and addressed to the appropriate Regional Office of the Environmental Protection Agency, to the attention of the Director, Enforcement Division. The regional offices are as follows:

Region I (Connecticut, Maine, New Hampshire, Massachusetts, Rhode Island, Vermont), John F. Kennedy Federal Building, Boston, Massachusetts 02203.

Region II (New York, New Jersey, Puerto Rico, Virgin Islands), Federal Office Building, 26 Federal Plaza (Foley Square), New York, N.Y. 10007.

Region III (Delaware, District of Columbia, Pennsylvania, Maryland, Virginia, West Virginia), Curtis Building, Sixth and Walnut Streets, Philadelphia, Pennsylvania 19106.

Region IV (Alabama, Florida, Georgia, Mississippi, Kentucky, North Carolina, South Carolina, Tennessee), Suite 300, 1421 Peachtree Street, Atlanta, Georgia 30309.

Region V (Illinois, Indiana, Minnesota, Michigan, Ohio, Wisconsin), 1 North Wacker Drive, Chicago, Illinois 60606.

Region VI (Arkansas, Louisiana, New Mexico, Oklahoma, Texas), 1600 Patterson Street, Dallas, Texas 75201.

Region VII (Iowa, Kansas, Missouri, Nebraska), 1735 Baltimore Street, Kansas City, Missouri 63108.

Region VIII (Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming), 196 Lincoln Towers, 1860 Lincoln Street, Denver, Colorado 80203.

Region IX (Arizona, California, Hawaii, Nevada, Guam, American Samoa), 100 California Street, San Francisco, California 94111.

Region X (Washington, Oregon, Idaho, Alaska), 1200 Sixth Avenue, Seattle, Washington 98101.

(b) Section 111(c) directs the Administrator to delegate to each State, when appropriate, the authority to implement and enforce standards of performance for new stationary sources located in such State. All information required to be submitted to EPA under paragraph (a) of this section, must also be submitted to the appropriate State Agency of any State to which this authority has been delegated (provided, that each specific delegation may except sources from a certain Federal or State reporting requirement). The appropriate mailing address for those States whose delegation request has been approved is as follows:

(A)–(Z) [reserved].
(AA)–(VV) [reserved].
WW–Washington: State of Washington, Department of Ecology, Olympia, Washington 98504.
(XX)–(ZZ) [reserved].
(AAA)–(DDD) [reserved].

[FR Doc.75-10797 Filed 4-24-75;8:45 am]

FEDERAL REGISTER, VOL. 40, NO. 81—FRIDAY, APRIL 25, 1975

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[FRL [illegible]]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Delegation of Authority to State of Idaho

Pursuant to the delegation of authority for the standards of performance for new stationary sources (NSPS) to the State of Idaho on June 9, 1975, EPA is today amending 40 CFR 60.4, Address, to reflect this delegation. A notice announcing this delegation is published today at 40 FR 26728. The amended § 60.4, which adds the address of the State of Idaho, Department of Health and Welfare to which all reports, requests, applications, submittals, and communications to the Administrator pursuant to this part must also be addressed, is set forth below.

The Administrator finds good cause for foregoing prior public notice and for making this rulemaking effective immediately in that it is an administrative change and not one of substantive content. No additional substantive burdens are imposed on the parties affected. The delegation which is reflected by this administrative amendment was effective on June 9, 1975, and it serves no purpose to delay the technical change of this addition of the State address to the Code of Federal Regulations.

This rulemaking is effective immediately, and is issued under the authority of section 111 of the Clean Air Act, as amended.

(42 U.S.C. 1857c–6.)

Dated: June 18, 1975.

ROBERT H. BAUM,
Acting Assistant Administrator
for Enforcement.

Part 60 of Chapter I, Title 40 of the Code of Federal Regulations is amended as follows:

1. In § 60.4 paragraph (b) is amended by revising subparagraph (N) to read as follows:

§ 60.4 Address.

* * * * *

(b) * * *

(A)–(M) * * *
(N) State of Idaho, Department of Health and Welfare, Statehouse, Boise, Idaho, 83701.

* * * * *

[FR Doc.75-16588 Filed 6-24-75;8:45 am]

FEDERAL REGISTER, VOL. 40, NO. 123—WEDNESDAY, JUNE 25, 1975

Title 40—Protection of Environment

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

[FRL 392-7]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Five Categories of Sources in the Phosphate Fertilizer Industry

On October 22, 1974 (39 FR 37602), under section 111 of the Clean Air Act, as amended, the Administrator proposed standards of performance for five new affected facilities within the phosphate fertilizer industry as follows: Wet-process phosphoric acid plants, superphosphoric acid plants, diammonium phosphate plants, triple superphosphate plants, and granular triple superphosphate storage facilities.

Interested parties participated in the rulemaking by sending comments to EPA. The Freedom of Information Center, Rm 202 West Tower, 401 M Street, SW., Washington, D.C. has copies of the comment letters received and a summary of the issues and Agency responses available for public inspection. In addition, copies of the issue summary and Agency responses may be obtained upon written request from the EPA Public Information Center (PM-215), 401 M Street, SW., Washington, D.C. 20460 (specify "Comment Summary: Phosphate Fertilizer Industry"). The comments have been considered and where determined by the Administrator to be appropriate, revisions have been made to the proposed standards, and the revised version of the standards of performance for five source categories within the phosphate fertilizer industry are herein promulgated. The principal revisions to the proposed standards and the Agency's responses to major comments are summarized below.

DEFINITIONS

The comment was made that the designation of affected facilities (§§ 60.200, 60.210, 60.220, 60.230, and 60.240) were confusing as written in the proposed regulations. As a result of the proposed wording, each component of an affected facility could have been considered a separate affected facility. Since this was not the intent, the affected facility designations have been reworded. In the new wording, the listing of components of an affected facility is intended for identification of those emission sources to which the standard for fluorides applies. Any sources not listed are not covered by the standard. Additionally, the definition of a "superphosphoric acid plant" has been changed to include facilities which concentrate wet-process phosphoric acid to 66 percent or greater P_2O_5 content instead of 60 percent as specified in the proposed regulations. This was the result of a comment stating that solvent extracted acids could be evaporated to greater than 60 percent P_2O_5 using conventional evaporators in the wet-process phosphoric acid plant. The revision clarifies the original intention of preventing certain wet-process phosphoric acid plants from being subject to the more restrictive standard for superphosphoric acid plants.

One commentator was concerned that a loose interpretation of the definition of the affected facility for diammonium phosphate plants might result in certain liquid fertilizer plants becoming subject to the standards. Therefore, the word "granular" has been inserted before "diammonium phosphate plant" in the appropriate places in subpart V to clarify the intended meaning.

Under the standards for triple superphosphate plants in § 60.231(b), the term "by weight" has been added to the definition of "run-of-pile triple superphosphate." Apparently it was not clear as to whether "25 percent of which (when not caked) will pass through a 16 mesh screen" referred to percent by weight or by particle count.

OPACITY STANDARDS

Many commentators challenged the proposed opacity standards on the grounds that EPA had shown no correlation between fluoride emissions and plume opacity, and that no data were presented which showed that a violation of the proposed opacity standard would indicate simultaneous violation of the proposed fluoride standard. For the opacity standard to be used as an enforcement tool to indicate possible violation of the fluoride standard, such a correlation must be established. The Agency has reevaluated the opacity test data and determined that the correlation is insufficient to support a standard. Therefore, standards for visible emissions for diammonium phosphate plants, triple superphosphate plants, and granular triple superphosphate storage facilities have been deleted. This action, however, is not meant to set a precedent regarding promulgation of visible emission standards. The situation which necessitates this decision relates only to fluoride emissions. In the future, the Agency will continue to set opacity standards for affected facilities where such standards are desirable and warranted based on test data.

In place of the opacity standard, a provision has been added which requires an owner or operator to monitor the total pressure drop across an affected facility's scrubbing system. This requirement will provide an affected facility's scrubbing system. This requirement will provide for a record of the operating conditions of the control system, and will serve as an effective method for monitoring compliance with the fluoride standards.

REFERENCE METHODS 13A AND 13B

Reference Methods 13A and 13B, which prescribed testing and analysis procedures for fluoride emissions, were originally proposed along with standards of performance for the primary aluminum industry (39 FR 37730). However, these methods have been included with the standards of performance for the phosphate fertilizer industry and the the fertilizer standards are being promulgated before the primary aluminum standards. Comments were received from the phosphate fertilizer industry and the primary aluminum industry as the methods are applicable to both industries. The majority of the comments discussed possible changes to procedures and to equipment specifications. As a result of these comments some minor changes were made. Additionally, it has been determined that acetone causes a positive interference in the analytical procedures. Although the bases for the standard are not affected, the acetone wash has been deleted in both methods to prevent potential errors. Reference Method 13A has been revised to restrict the distillation procedure (Section 7.3.4) to 175°C instead of the proposed 180°C in order to prevent positive interferences introduced by sulfuric acid carryover in the distillate at the higher temperatures. Some commentators expressed a desire to replace the methods with totally different methods of analysis. They felt they should not be restricted to using only those methods published by the Agency. However, in response to these comments, an equivalent or alternative method may be used after approval by the Administrator according to the provisions of § 60.8(b) of the regulations (as revised in 39 FR 9308).

FLUORIDE CONTROL

Comments were received which questioned the need for Federal fluoride control because fluoride emissions are localized and ambient fluoride concentrations are very low. As discussed in the preamble to the proposed regulations, fluoride was the only pollutant other than the criteria pollutants, specifically named as requiring Federal action in the March 1970 "Report of the Secretary of Health, Education, and Welfare to the United States (91st) Congress." The report concluded that "inorganic fluorides are highly irritant and toxic gases" which, even in low ambient concentrations, have adverse effects on plants and animals. The United States Senate Committee on Public Works in its report on the Clean Air Amendments of 1970 (Senate Report No. 91-1196, September 17, 1970, page 9) included fluorides on a list of contaminants which have broad national impact and require Federal action.

One commentator questioned EPA's use of section 111 of the Clean Air Act, as amended, as a means of controlling fluoride air pollution. Again, as was mentioned in the preamble to the proposed regulations, the "Preferred Standards Path Report for Fluorides" (November 1972) concluded that the most appropriate control strategy is through section 111. A copy of this report is available for inspection during normal business hours at the Freedom of Information Center, Environmental Protection Agency, 401 M Street, SW., Washington, D.C.

Another objection was voiced concerning the preamble statement that the "phosphate fertilizer industry is a major source of fluoride air pollution." According to the "Engineering and Cost Effectiveness Study of Fluoride Emissions

Control" (Contract EHSD 71-14) published in January 1972, the phosphate fertilizer industry ranks near the top of the list of fluoride emitters in the U.S., accounting for nearly 14 percent of the total soluble fluorides emitted every year. The Agency contends that these facts justify naming the phosphate fertilizer industry a major source of fluorides.

DIAMMONIUM PHOSPHATE STANDARD

One commentator contended that the fluoride standard for diammonium phosphate plants could not be met under certain extreme conditions. During periods of high air flow rates through the scrubbing system, high ambient temperatures, and high fluoride content in scrubber liquor, the commentator suggested that the standard would not be met even by sources utilizing best demonstrated control technology. This comment was refuted for two reasons: (1) The surmised extreme conditions would not occur and (2) even if the conditions did occur, the performance of the control system would be such as to meet the standard anyway. Thus the fluoride standard for diammonium phosphate plants was not revised.

POND WATER STANDARDS

The question of the standards for pond water was raised in the comments. The commentator felt that it would have been more logical if the Agency had postponed proposal of the phosphate fertilizer regulations until standards of performance for pond water had also been decided upon, instead of EPA saying that such pond water standards might be set in the future. EPA researched pond water standards along with the other fertilizer standards, but due to the complex nature of pond chemistry and a general lack of available information, simultaneous proposal was not feasible. Rather than delay new source fluoride control regulations, possibly for several years, the Agency decided to proceed with standards for five categories of sources within the industry.

ECONOMIC IMPACT

As was indicated by the comments received, clarification of some of the Agency's statements concerning the economic impact of the standards is necessary. First, the statement that "for three of the five standards there will be no increase in power consumption over that which results from State and local standards" is misleading as written in the preamble to the proposed regulations. The statement should have been qualified in that this conclusion was based on projected construction in the industry through 1980, and was not meant to be applicable past that time. Second, some comments suggested that the cost data in the background document were out of date. Of course the time between the gathering of economic data and the proposal of regulations may be as long as a year or two because of necessary intermediate steps in the standard setting process, however, the economic data are developed with future industry growth and financial status in mind, and therefore, the analysis should be viable at the time of standard proposal. Third, an objection was raised to the statement that "the disparity in cost between triple superphosphate and diammonium phosphate will only hasten the trend toward production of diammonium phosphate." The commentator felt that EPA should not place itself in a position of regulating fertilizer production. In response, the Agency does not set standards to regulate production. The standards are set to employ the best system of emission reduction considering cost. The standards will basically require use of a packed scrubber for compliance in each of the five phosphate fertilizer source categories. In this instance, control costs (although considered reasonable for both source categories) are higher for triple superphosphate plants than for diammonium phosphate plants. The reasons for this are that (1) larger gas volumes must be scrubbed in triple superphosphate facilities and (2) triple superphosphate storage facility emissions must also be scrubbed. However, the greater costs can be partially offset in a plant producing both granular triple superphosphate and diammonium phosphate with the same manufacturing facility and same control device. Such a facility can optimize utilization of the owner's capital by operating his phosphoric acid plant at full capacity and producing a product mix that will maximize profits. The information gathered by the Agency indicates that all new facilities equipped to manufacture diammonium phosphate will also produce granular triple superphosphate to satisfy demand for direct application materials and exports.

CONTROL OF TOTAL FLUORIDES

Most of the commentators objected to EPA's control of "total fluorides" rather than "gaseous and water soluble fluorides." The rationale for deciding to set standards for total fluorides is presented on pages 5 and 6 of volume 1 of the background document. Essentially the rationale is that some "insoluble" fluoride compounds will slowly dissolve if allowed to remain in the water-impinger section of the sample train. Since EPA did not closely control the time between capture and filtration of the fluoride samples, the change was made to insure a more accurate data base. Additional comments on this subject revealed concern that the switch to total fluorides would bring phosphate rock operations under the standards. EPA did not intend such operations to be controlled by these regulations, and did not include them in the definitions of affected facilities; however, standards for these operations are currently under development within the Agency.

MONITORING REQUIREMENTS

Several comments were received with regard to the sections requiring a flow measuring device which has an accuracy of ± 5 percent over its operating range. The commentators felt that this accuracy could not be met and that the capital and operating costs outweighed anticipated utility. First of all, "weigh-belts" are common devices in the phosphate fertilizer industry as raw material feeds are routinely measured. EPA felt there would be no economic impact resulting from this requirement because plants would have normally installed weighing devices anyway. Second, contacts with the industry led EPA to believe that the ± 5 percent accuracy requirement would be easily met, and a search of pertinent literature showed that weighing devices with ± 1 percent accuracy are commercially available.

PERFORMANCE TEST PROCEDURES

Finally some comments specifically addressed § 60.245 (now § 60.244) of the proposed granular triple superphosphate storage facility standards. The first two remarks contended that it is impossible to tell when the storage building is filled to at least 10 percent of the building capacity without requiring an expensive engineering survey, and that it was also impossible to tell how much triple superphosphate in the building is fresh and how much is over 10 days old. EPA's experience has been that plants typically make surveys to determine the amount of triple superphosphate stored, and typically keep good records of the movement of triple superphosphate into and out of storage so that it is possible to make a good estimate of the age and amount of product. In light of data gathered during testing, the Agency disagrees with the above contentions and feels the requirements are reasonable. A third comment stated that § 60.244 (proposed § 60.245) was too restrictive, could not be met with partially filled storage facilities, and that the 10 percent requirement was not valid or practical. In response, the requirement of § 60.244(d)(1) is that "at least 10 percent of the building capacity" contain granular triple superphosphate. This means that, for a performance test, an owner or operator could have more than 10 percent of the building filled. In fact it is to his advantage to have more than 10 percent because of the likelihood of decreased emissions (in units of the standard) as calculated by the equation in § 60.244(g). The data obtained by the Agency show that the standard can be met with partially filled buildings. One commentator did not agree with the requirement in § 60.244(e) [proposed § 60.245(e)] to have at least five days maximum production of fresh granular triple superphosphate in the storage building before a performance test. The commentator felt this section was unreasonable because it dictated production schedules for triple superphosphate. However, this section applies only when the requirements of § 60.244(d)(2) [proposed § 60.245(d)(2)] are not met. In addition this requirement is not unreasonable regarding production schedules because performance tests are not required at regular intervals. A performance test is conducted after a facility begins operation; additional performance tests are conducted only when the facility is suspected of violation of the standard of performance.

Effective date. In accordance with section 111 of the Act, these regulations prescribing standards of performance for the selected stationary sources are effective on August 4, 1975, and apply to sources at which construction or modification commenced after October 22, 1974.

RUSSELL E. TRAIN,
Administrator.

JULY 25, 1975.

Part 60 of Chapter I, Title 40 of the Code of Federal Regulations is amended as follows:

1. The table of sections is amended by adding Subparts T, U, V, W, and X and revising Appendix A to read as follows:

* * * * *

Subpart T—Standards of Performance for the Phosphate Fertilizer Industry: Wet Process Phosphoric Acid Plants

60.200 Applicability and designation of affected facility.
60.201 Definitions.
60.202 Standard for fluorides.
60.203 Monitoring of operations.
60.204 Test methods and procedures.

Subpart U—Standards of Performance for the Phosphate Fertilizer Industry: Superphosphoric Acid Plants

60.210 Applicability and designation of affected facility.
60.211 Definitions.
60.212 Standard for fluorides.
60.213 Monitoring of operations.
60.214 Test methods and procedures.

Subpart V—Standards of Performance for the Phosphate Fertilizer Industry: Diammonium Phosphate Plants

60.220 Applicability and designation of affected facility.
60.221 Definitions.
60.222 Standard for fluorides.
60.223 Monitoring of operations.
60.224 Test methods and procedures.

Subpart W—Standards of Performance for the Phosphate Fertilizer Industry: Triple Superphosphate Plants

60.230 Applicability and designation of affected facility.
60.231 Definitions.
60.232 Standard for fluorides.
60.233 Monitoring of operations.
60.234 Test methods and procedures.

Subpart X—Standards of Performance for the Phosphate Fertilizer Industry: Granular Triple Superphosphate Storage Facilities

60.240 Applicability and designation of affected facility.
60.241 Definitions.
60.242 Standard for fluorides.
60.243 Monitoring of operations.
60.244 Test methods and procedures.

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APPENDIX A—REFERENCE METHODS

Method 1—Sample and velocity traverses for stationary sources.
Method 2—Determination of stack gas velocity and volumetric flow rate (Type S pitot tube).
Method 3—Gas analysis for carbon dioxide, excess air, and dry molecular weight.
Method 4—Determination of moisture in stack gases.
Method 5—Determination of particulate emissions from stationary sources.
Method 6—Determination of sulfur dioxide emissions from stationary sources.
Method 7—Determination of nitrogen oxide emissions from stationary sources.
Method 8—Determination of sulfuric acid mist and sulfur dioxide emissions from stationary sources.
Method 9—Visual determination of the opacity of emissions from stationary sources.
Method 10—Determination of carbon monoxide emissions from stationary sources.
Method 11—Determination of hydrogen sulfide emissions from stationary sources.
Method 12—Reserved.
Method 13A—Determination of total fluoride emissions from stationary sources—SPADNS Zirconium Lake Method.
Method 13B—Determination of total fluoride emissions from stationary sources—Specific Ion Electrode Method.

2. Part 60 is amended by adding subparts T, U, V, W, and X as follows:

Subpart T—Standards of Performance for the Phosphate Fertilizer Industry: Wet-Process Phosphoric Acid Plants

§ 60.200 Applicability and designation of affected facility.

The affected facility to which the provisions of this subpart apply is each wet-process phosphoric acid plant. For the purpose of this subpart, the affected facility includes any combination of: reactors, filters, evaporators, and hotwells.

§ 60.201 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in subpart A of this part.

(a) "Wet-process phosphoric acid plant" means any facility manufacturing phosphoric acid by reacting phosphate rock and acid.

(b) "Total fluorides" means elemental fluorine and all fluoride compounds as measured by reference methods specified in § 60.204, or equivalent or alternative methods.

(c) "Equivalent P_2O_5 feed" means the quantity of phosphorus, expressed as phosphorous pentoxide, fed to the process.

§ 60.202 Standard for fluorides.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility any gases which contain total fluorides in excess of 10.0 g/metric ton of equivalent P_2O_5 feed (0.020 lb/ton).

§ 60.203 Monitoring of operations.

(a) The owner or operator of any wet-process phosphoric acid plant subject to the provisions of this subpart shall install, calibrate, maintain, and operate a monitoring device which can be used to determine the mass flow of phosphorus-bearing feed material to the process. The monitoring device shall have an accuracy of ±5 percent over its operating range.

(b) The owner or operator of any wet-process phosphoric acid plant shall maintain a daily record of equivalent P_2O_5 feed by first determining the total mass rate in metric ton/hr of phosphorus bearing feed using a monitoring device for measuring mass flowrate which meets the requirements of paragraph (a) of this section and then by proceeding according to § 60.204(d)(2).

(c) The owner or operator of any wet-process phosphoric acid subject to the provisions of this part shall install, calibrate, maintain, and operate a monitoring device which continuously measures and permanently records the total pressure drop across the process scrubbing system. The monitoring device shall have an accuracy of ±5 percent over its operating range.

§ 60.204 Test methods and procedures.

(a) Reference methods in Appendix A of this part, except as provided in § 60.8(b), shall be used to determine compliance with the standard prescribed in § 60.202 as follows:

(1) Method 13A or 13B for the concentration of total fluorides and the associated moisture content,

(2) Method 1 for sample and velocity traverses,

(3) Method 2 for velocity and volumetric flow rate, and

(4) Method 3 for gas analysis.

(b) For Method 13A or 13B, the sampling time for each run shall be at least 60 minutes and the minimum sample volume shall be 0.85 dscm (30 dscf) except that shorter sampling times or smaller volumes, when necessitated by process variables or other factors, may be approved by the Administrator.

(c) The air pollution control system for the affected facility shall be constructed so that volumetric flow rates and total fluoride emissions can be accurately determined by applicable test methods and procedures.

(d) Equivalent P_2O_5 feed shall be determined as follows:

(1) Determine the total mass rate in metric ton/hr of phosphorus-bearing feed during each run using a flow monitoring device meeting the requirements of § 60.203(a).

(2) Calculate the equivalent P_2O_5 feed by multiplying the percentage P_2O_5 content, as measured by the spectrophotometric molybdovanadophosphate method (AOAC Method 9), times the total mass rate of phosphorus-bearing feed. AOAC Method 9 is published in the Official Methods of Analysis of the Association of Official Analytical Chemists, 11th edition, 1970, pp. 11–12. Other methods may be approved by the Administrator.

(e) For each run, emissions expressed in g/metric ton of equivalent P_2O_5 feed shall be determined using the following equation:

$$E=\frac{(C_s Q_s)\ 10^{-3}}{M_{P_2O_5}}$$

where:

E = Emissions of total fluorides in g/metric ton of equivalent P_2O_5 feed.
C_s = Concentration of total fluorides in mg/dscm as determined by Method 13A or 13B.
Q_s = Volumetric flow rate of the effluent gas stream in dscm/hr as determined by Method 2.
10^{-3} = Conversion factor for mg to g.
$M_{P_2O_5}$ = Equivalent P_2O_5 feed in metric ton/hr as determined by § 60.204(d).

Subpart U—Standards of Performance for the Phosphate Fertilizer Industry: Superphosphoric Acid Plants

§ 60.210 Applicability and designation of affected facility.

The affected facility to which the provisions of this subpart apply is each superphosphoric acid plant. For the purpose of this subpart, the affected facility includes any combination of: evaporators, hotwells, acid sumps, and cooling tanks.

§ 60.211 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in subpart A of this part.

(a) "Superphosphoric acid plant" means any facility which concentrates wet-process phosphoric acid to 66 percent or greater P_2O_5 content by weight for eventual consumption as a fertilizer.

(b) "Total fluorides" means elemental fluorine and all fluoride compounds as measured by reference methods specified in § 60.214, or equivalent or alternative methods.

(c) "Equivalent P_2O_5 feed" means the quantity of phosphorus, expressed as phosphorous pentoxide, fed to the process.

§ 60.212 Standard for fluorides.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility any gases which contain total fluorides in excess of 5.0 g/metric ton of equivalent P_2O_5 feed (0.010 lb/ton).

§ 60.213 Monitoring of operations.

(a) The owner or operator of any superphosphoric acid plant subject to the provisions of this subpart shall install, calibrate, maintain, and operate a flow monitoring device which can be used to determine the mass flow of phosphorus-bearing feed material to the process. The flow monitoring device shall have an accuracy of ± 5 percent over its operating range.

(b) The owner or operator of any superphosphoric acid plant shall maintain a daily record of equivalent P_2O_5 feed by first determining the total mass rate in metric ton/hr of phosphorus-bearing feed using a flow monitoring device meeting the requirements of paragraph (a) of this section and then by proceeding according to § 60.214(d)(2).

(c) The owner or operator of any superphosphoric acid plant subject to the provisions of this part shall install, calibrate, maintain, and operate a monitoring device which continuously measures and permanently records the total pressure drop across the process scrubbing system. The monitoring device shall have an accuracy of ± 5 percent over its operating range.

§ 60.214 Test methods and procedures.

(a) Reference methods in Appendix A of this part, except as provided for in § 60.8(b), shall be used to determine compliance with the standard prescribed in § 60.212 as follows:

(1) Method 13A or 13B for the concentration of total fluorides and the associated moisture content.

(2) Method 1 for sample and velocity traverses,

(3) Method 2 for velocity and volumetric flow rate, and

(4) Method 3 for gas analysis.

(b) For Method 13A or 13B, the sampling time for each run shall be at least 60 minutes and the minimum sample volume shall be at least 0.85 dscm (30 dscf) except that shorter sampling times or smaller volumes, when necessitated by process variables or other factors, may be approved by the Administrator.

(c) The air pollution control system for the affected facility shall be constructed so that volumetric flow rates and total fluoride emissions can be accurately determined by applicable test methods and procedures.

(d) Equivalent P_2O_5 feed shall be determined as follows:

(1) Determine the total mass rate in metric ton/hr of phosphorus-bearing feed during each run using a flow monitoring device meeting the requirements of § 60.213(a).

(2) Calculate the equivalent P_2O_5 feed by multiplying the percentage P_2O_5 content, as measured by the spectrophotometric molybdovanadophosphate method (AOAC Method 9), times the total mass rate of phosphorus-bearing feed. AOAC Method 9 is published in the Official Methods of Analysis of the Association of Official Analytical Chemists, 11th edition, 1970, pp. 11–12. Other methods may be approved by the Administrator.

(e) For each run, emissions expressed in g/metric ton of equivalent P_2O_5 feed, shall be determined using the following equation:

$$E=\frac{(C_s Q_s)\ 10^{-3}}{M_{P_2O_5}}$$

where:

E = Emissions of total fluorides in g/metric ton of equivalent P_2O_5 feed.

C_s = Concentration of total fluorides in mg/dscm as determined by Method 13A or 13B.

Q_s = Volumetric flow rate of the effluent gas stream in dscm/hr as determined by Method 2.

10^{-3} = Conversion factor for mg to g.

$M_{P_2O_5}$ = Equivalent P_2O_5 feed in metric ton/hr as determined by § 60.214(d).

Subpart V—Standards of Performance for the Phosphate Fertilizer Industry: Diammonium Phosphate Plants

§ 60.220 Applicability and designation of affected facility.

The affected facility to which the provisions of this subpart apply is each granular diammonium phosphate plant. For the purpose of this subpart, the affected facility includes any combination of: reactors, granulators, dryers, coolers, screens and mills.

§ 60.221 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in subpart A of this part.

(a) "Granular diammonium phosphate plant" means any plant manufacturing granular diammonium phosphate by reacting phosphoric acid with ammonia.

(b) "Total fluorides" means elemental fluorine and all fluoride compounds as measured by reference methods specified in § 60.224, or equivalent or alternative methods.

(c) "Equivalent P_2O_5 feed" means the quantity of phosphorus, expressed as phosphorous pentoxide, fed to the process.

§ 60.222 Standard for fluorides.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility any gases which contain total fluorides in excess of 30 g/metric ton of equivalent P_2O_5 feed (0.060 lb/ton).

§ 60.223 Monitoring of operations.

(a) The owner or operator of any granular diammonium phosphate plant subject to the provisions of this subpart shall install, calibrate, maintain, and operate a flow monitoring device which can be used to determine the mass flow of phosphorus-bearing feed material to the process. The flow monitoring device shall have an accuracy of ±5 percent over its operating range.

(b) The owner or operator of any granular diammonium phosphate plant shall maintain a daily record of equivalent P_2O_5 feed by first determining the total mass rate in metric ton/hr of phosphorus-bearing feed using a flow monitoring device meeting the requirements of paragraph (a) of this section and then by proceeding according to § 60.224(d)(2).

(c) The owner or operator of any granular diammonium phosphate plant subject to the provisions of this part shall install, calibrate, maintain, and operate a monitoring device which continuously measures and permanently records the total pressure drop across the scrubbing system. The monitoring device shall have an accuracy of ±5 percent over its operating range.

§ 60.224 Test methods and procedures.

(a) Reference methods in Appendix A of this part, except as provided for in § 60.8(b), shall be used to determine compliance with the standard prescribed in § 60.222 as follows:

(1) Method 13A or 13B for the concentration of total fluorides and the associated moisture content,

(2) Method 1 for sample and velocity traverses,

(3) Method 2 for velocity and volumetric flow rate, and

(4) Method 3 for gas analysis.

(b) For Method 13A or 13B, the sampling time for each run shall be at least 60 minutes and the minimum sample volume shall be at least 0.85 dscm (30 dscf) except that shorter sampling times or smaller volumes when necessitated by process variables or other factors, may be approved by the Administrator.

(c) The air pollution control system for the affected facility shall be constructed so that volumetric flow rates and total fluoride emissions can be accurately determined by applicable test methods and procedures.

(d) Equivalent P_2O_5 feed shall be determined as follows:

(1) Determine the total mass rate in metric ton/hr of phosphorus-bearing feed during each run using a flow monitoring device meeting the requirements of § 60.223(a).

(2) Calculate the equivalent P_2O_5 feed by multiplying the percentage P_2O_5 content, as measured by the spectrophotometric molybdovanadophosphate method (AOAC Method 9), times the total mass rate of phosphorus-bearing feed. AOAC Method 9 is published in the Official Methods of Analysis of the Association of Official Analytical Chemists, 11th edition, 1970, pp. 11–12. Other methods may be approved by the Administrator.

(e) For each run, emissions expressed in g/metric ton of equivalent P_2O_5 feed shall be determined using the following equation:

$$E=\frac{(C_sQ_s)\ 10^{-3}}{M_{P_2O_5}}$$

where:

E = Emissions of total fluorides in g/metric ton of equivalent P_2O_5.

C_s = Concentration of total fluorides in mg/dscm as determined by Method 13A or 13B.

Q_s = Volumetric flow rate of the effluent gas stream in dscm/hr as determined by Method 2.

10^{-3} = Conversion factor for mg to g.

$M_{P_2O_5}$ = Equivalent P_2O_5 feed in metric ton/hr as determined by § 60.224(d).

Subpart W—Standards of Performance for the Phosphate Fertilizer Industry: Triple Superphosphate Plants

§ 60.230 Applicability and designation of affected facility.

The affected facility to which the provisions of this subpart apply is each triple superphosphate plant. For the purpose of this subpart, the affected facility includes any combination of: Mixers, curing belts (dens), reactors, granulators, dryers, cookers, screens, mills and facilities which store run-of-pile triple superphosphate.

§ 60.231 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in subpart A of this part.

(a) "Triple superphosphate plant" means any facility manufacturing triple superphosphate by reacting phosphate rock with phosphoric acid. A rule-of-pile triple superphosphate plant includes curing and storing.

(b) "Run-of-pile triple superphosphate" means any triple superphosphate that has not been processed in a granulator and is composed of particles at least 25 percent by weight of which (when not caked) will pass through a 16 mesh screen.

(c) "Total fluorides" means elemental fluorine and all fluoride compounds as measured by reference methods specified in § 60.234, or equivalent or alternative methods.

(d) "Equivalent P_2O_5 feed" means the quantity of phosphorus, expressed as phosphorus pentoxide, fed to the process.

§ 60.232 Standard for fluorides.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility any gases which contain total fluorides in excess of 100 g/metric ton of equivalent P_2O_5 feed (0.20 lb/ton).

§ 60.233 Monitoring of operations.

(a) The owner or operator of any triple superphosphate plant subject to the provisions of this subpart shall install, calibrate, maintain, and operate a flow monitoring device which can be used to determine the mass flow of phosphorus-bearing feed material to the process. The flow monitoring device shall have an accuracy of ±5 percent over its operating range.

(b) The owner or operator of any triple superphosphate plant shall maintain a daily record of equivalent P_2O_5 feed by first determining the total mass rate in metric ton/hr of phosphorus-bearing feed using a flow monitoring device meeting the requirements of paragraph (a) of this section and then by proceeding according to § 60.234(d)(2).

(c) The owner or operator of any triple superphosphate plant subject to the provisions of this part shall install, calibrate, maintain, and operate a monitoring device which continuously measures and permanently records the total pressure drop across the process scrubbing system. The monitoring device shall have an accuracy of ±5 percent over its operating range.

§ 60.234 Test methods and procedures.

(a) Reference methods in Appendix A of this part, except as provided for in § 60.8(b), shall be used to determine compliance with the standard prescribed in § 60.232 as follows:

(1) Method 13A or 13B for the concentration of total fluorides and the associated moisture content,

(2) Method 1 for sample and velocity traverses,

(3) Method 2 for velocity and volumetric flow rate, and

(4) Method 3 for gas analysis.

(b) For Method 13A or 13B, the sampling time for each run shall be at least 60 minutes and the minimum sample volume shall be at least 0.85 dscm (30 dscf) except that shorter sampling times or smaller volumes, when necessitated by process variables or other factors, may be approved by the Administrator.

(c) The air pollution control system for the affected facility shall be constructed so that volumetric flow rates and total fluoride emissions can be accurately determined by applicable test methods and procedures.

(d) Equivalent P_2O_5 feed shall be determined as follows:

(1) Determine the total mass rate in metric ton/hr of phosphorus-bearing feed during each run using a flow monitoring device meeting the requirements of § 60.233(a).

(2) Calculate the equivalent P_2O_5 feed by multiplying the percentage P_2O_5 content, as measured by the spectrophotometric molybdovanadophosphate method (AOAC Method 9), times the total mass rate of phosphorus-bearing feed. AOAC Method 9 is published in the Official Methods of Analysis of the Association of Official Analytical Chemists, 11th edition, 1970, pp. 11–12. Other methods may be approved by the Administrator.

(e) For each run, emissions expressed in g/metric ton of equivalent P_2O_5 feed shall be determined using the following equation:

$$E=\frac{(C_sQ_s)\ 10^{-3}}{M_{P_2O_5}}$$

where:

E = Emissions of total fluorides in g/metric ton of equivalent P_2O_5 feed.

C_s = Concentration of total fluorides in mg/dscm as determined by Method 13A or 13B.

Q_s = Volumetric flow rate of the effluent gas stream in dscm/hr as determined by Method 2.

10^{-3} = Conversion factor for mg to g.

$M_{P_2O_5}$ = Equivalent P_2O_5 feed in metric ton/hr as determined by § 60.234(d).

Subpart X—Standards of Performance for the Phosphate Fertilizer Industry: Granular Triple Superphosphate Storage Facilities

§ 60.240 Applicability and designation of affected facility.

The affected facility to which the provisions of this subpart apply is each granular triple superphosphate storage facility. For the purpose of this subpart, the affected facility includes any combination of: storage or curing piles, conveyors, elevators, screens and mills.

§ 60.241 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in subpart A of this part.

(a) "Granular triple superphosphate storage facility" means any facility curing or storing granular triple superphosphate.

(b) "Total fluorides" means elemental fluorine and all fluoride compounds as measured by reference methods specified in § 60.244, or equivalent or alternative methods.

(c) "Equivalent P_2O_5 stored" means the quantity of phosphorus, expressed as phosphorus pentoxide, being cured or stored in the affected facility.

(d) "Fresh granular triple superphosphate" means granular triple superphosphate produced no more than 10 days prior to the date of the performance test.

§ 60.242 Standard for fluorides.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility any gases which contain total fluorides in excess of 0.25 g/hr/metric ton of equivalent P_2O_5 stored (5.0 x 10^{-4} lb/hr/ton of equivalent P_2O_5 stored).

§ 60.243 Monitoring of operations.

(a) The owner or operator of any granular triple superphosphate storage facility subject to the provisions of this subpart shall maintain an accurate account of triple superphosphate in storage to permit the determination of the amount of equivalent P_2O_5 stored.

(b) The owner or operator of any granular triple superphosphate storage facility shall maintain a daily record of total equivalent P_2O_5 stored by multiplying the percentage P_2O_5 content, as determined by § 60.244(f)(2), times the total mass of granular triple superphosphate stored.

(c) The owner or operator of any granular triple superphosphate storage facility subject to the provisions of this part shall install, calibrate, maintain, and operate a monitoring device which continuously measures and permanently records the total pressure drop across the process scrubbing sytem. The monitoring device shall have an accuracy of ±5 percent over its operating range.

§ 60.244 Test methods and procedures.

(a) Reference methods in Appendix A of this part, except as provided for in § 60.8(b), shall be used to determine compliance with the standard prescribed in § 60.242 as follows:

(1) Method 13A or 13B for the concentration of total fluorides and the associated moisture content,

(2) Method 1 for sample and velocity traverses,

(3) Method 2 for velocity and volumetric flow rate, and

(4) Method 3 for gas analysis.

(b) For Method 13A or 13B, the sampling time for each run shall be at least 60 minutes and the minimum sample volume shall be at least 0.85 dscm (30 dscf) except that shorter sampling times or smaller volumes, when necessitated by process variables or other factors, may be approved by the Administrator.

(c) The air pollution control system for the affected facility shall be constructed so that volumetric flow rates and total fluoride emissions can be accurately determined by applicable test methods and procedures.

(d) Except as provided under paragraph (e) of this section, all performance tests on granular triple superphosphate storage facilities shall be conducted only when the following quantities of product are being cured or stored in the facility:

(1) Total granular triple superphosphate—at least 10 percent of the building capacity.

(2) Fresh granular triple superphosphate—at least 20 percent of the amount of triple superphosphate in the building.

(e) If the provisions set forth in paragraph (d)(2) of this section exceed production capabilities for fresh granular triple superphosphate, the owner or operator shall have at least five days maximum production of fresh granular triple superphosphate in the building during a performance test.

(f) Equivalent P_2O_5 stored shall be determined as follows:

(1) Determine the total mass stored during each run using an accountability system meeting the requirements of § 60.243(a).

(2) Calculate the equivalent P_2O_5 stored by multiplying the percentage P_2O_5 content, as measured by the spectrophotometric molybdovanadophosphate method (AOAC Method 9), times the total mass stored. AOAC Method 9 is published in the Afficial Methods of Analysis of the Association of Official Analytical Chemists, 11th edition, 1970, pp. 11–12. Other methods may be approved by the Administrator.

(g) For each run, emissions expressed in g/hr/metric ton of equivalent P_2O_5 stored shall be determined using the following equation:

$$E=\frac{(C_s Q_s)\ 10^{-3}}{M_{P_2O_5}}$$

where:

E = Emissions of total fluorides in g/hr/metric ton of equivalent P_2O_5 stored.

C_s = Concentration of total fluorides in mg/dscm as determined by Method 13A or 13B.

Q_s = Volumetric flow rate of the effluent gas stream in dscm/hr as determined by Method 2.

10^{-3} = Conversion factor for mg to g.

$M_{P_2O_5}$ = Equivalent P_2O_5 feed in metric tons as measured by § 60.244(d).

3. Part 60 is amended by adding Reference Methods 13A and 13B to Appendix A as follows:

METHOD 13—DETERMINATION OF TOTAL FLUORIDE EMISSIONS FROM STATIONARY SOURCES—SPADNS ZIRCONIUM LAKE METHOD

1. *Principle and Applicability.*

1.1 *Principle.* Gaseous and particulate fluorides are withdrawn isokinetically from the source using a sampling train. The fluorides are collected in the impinger water and on the filter of the sampling train. The weight of total fluorides in the train is determined by the SPADNS Zirconium Lake colorimetric method.

1.2 *Applicability.* This method is applicable for the determination of fluoride emissions from stationary sources only when specified by the test procedures for determining compliance with new source performance standards. Fluorocarbons, such as Freons, are not quantitatively collected or measured by this procedure.

2. *Range and Sensitivity.*

The SPADNS Zirconium Lake analytical method covers the range from 0–1.4 μg/ml fluoride. Sensitivity has not been determined.

3. *Interferences.*

During the laboratory analysis, aluminum in excess of 300 mg/liter and silicon dioxide in excess of 300 μg/liter will prevent complete recovery of fluoride. Chloride will distill over and interfere with the SPADNS Zirconium Lake color reaction. If chloride ion is present, use of Specific Ion Electrode (Method 13B) is recommended; otherwise a chloride determination is required and 5 mg of silver sulfate (see section 7.3.6) must be added for each mg of chloride to prevent chloride interference. If sulfuric acid is carried over in the distillation, it will cause a positive interference. To avoid sulfuric acid carryover, it is important to stop distillation at 175°C.

4. *Precision, Accuracy and Stability.*

4.1 *Analysis.* A relative standard deviation of 3 percent was obtained from twenty replicate intralaboratory determinations on stack emission samples with a concentration range of 39 to 360 mg/l. A phosphate rock standard which was analyzed by this procedure contained a certified value of 3.84 percent. The average of five determinations was 3.88 percent fluoride.

4.2 *Stability.* The color obtained when the sample and colorimetric reagent are mixed is stable for approximately two hours. After formation of the color, the absorbances of the sample and standard solutions should be measured at the same temperature. A 3°C temperature difference between sample and standard solutinos will produce an error of approximately 0.005 mg F/liter.

5. *Apparatus.*

5.1 *Sample train.* See Figure 13A–1; it is similar to the Method 5 train except for the interchangeability of the position of the filter. Commercial models of this train are available. However, if one desires to build his own, complete construction details are described in APTD–0581; for changes from the APTD–0581 document and for allowable modifications to Figure 13A–1, see the following subsections.

The operating and maintenance procedures for the sampling train are described in APTD–0576. Since correct usage is important in obtaining valid results, all users should read the APTD–0576 document and adopt the operating and maintenance procedures outlined in it, unless otherwise specified herein.

5.1.1 Probe nozzle—Stainless steel (316) with sharp, tapered leading edge. The angle of taper shall be $\leq 30°$ and the taper shall be on the outside to preserve a constant internal diameter. The probe nozzle shall be of the button-hook or elbow design, unless otherwise specified by the Administrator. The wall thickness of the nozzle shall be less than or equal to that of 20 gauge tubing, i.e., 0.165 cm (0.065 in.) and the distance from the tip of the nozzle to the first bend or point of disturbance shall be at least two times the outside nozzle diameter. The nozzle shall be constructed from seamless stainless steel tubing. Other configurations and construction material may be used with approval from the Administrator.

A range of sizes suitable for isokinetic sampling should be available, e.g., 0.32 cm ($\frac{1}{8}$ in.) up to 1.27 cm ($\frac{1}{2}$ in.) (or larger if higher volume sampling trains are used) inside diameter (ID) nozzles in increments of 0.16 cm ($\frac{1}{16}$ in.). Each nozzle shall be calibrated according to the procedures outlined in the calibration section.

5.1.2 Probe liner—Borosilicate glass or stainless steel (316). When the filter is located immediately after the probe, a probe heating system may be used to prevent filter plugging resulting from moisture condensation. The temperature in the probe shall not exceed 120 ± 14°C (248 ± 25°F).

5.1.3 Pitot tube—Type S, or other device approved by the Administrator, attached to probe to allow constant monitoring of the stack gas velocity. The face openings of the pitot tube and the probe nozzle shall be adjacent and parallel to each other, not necessarily on the same plane, during sampling. The free space between the nozzle and pitot tube shall be at least 1.9 cm (0.75 in.). The free space shall be set based on a 1.3 cm (0.5 in.) ID nozzle, which is the largest size nozzle used.

The pitot tube must also meet the criteria specified in Method 2 and be calibrated according to the procedure in the calibration section of that method.

5.1.4 Differential pressure gauge—Inclined manometer capable of measuring velocity head to within 10% of the minimum measured value. Below a differential pressure of 1.3 mm (0.05 in.) water gauge, micromanometers with sensitivities of 0.013 mm (0.0005 in.) should be used. However, micromanometers are not easily adaptable to field conditions and are not easy to use with pulsating flow. Thus, other methods or devices acceptable to the Administrator may be used when conditions warrant.

5.1.5 Filter holder—Borosilicate glass with a glass frit filter support and a silicone rubber gasket. Other materials of construction may be used with approval from the Administrator, e.g., if probe liner is stainless steel, then filter holder may be stainless steel. The holder design shall provide a positive seal against leakage from the outside or around the filter.

5.1.6 Filter heating system—When moisture condensation is a problem, any heating system capable of maintaining a temperature around the filter holder during sampling of no greater than 120±14°C (248±25°F). A temperature gauge capable of measuring temperature to within 3°C (5.4°F) shall be installed so that when the filter heater is used, the temperature around the filter holder can be regulated and monitored during sampling. Heating systems other than the one shown in APTD–0581 may be used.

5.1.7 Impingers—Four impingers connected as shown in Figure 13A–1 with ground glass (or equivalent), vacuum tight fittings. The first, third, and fourth impingers are of the Greenburg-Smith design, modified by replacing the tip with a 1¼ cm (½ in.) inside diameter glass tube extending to 1¼ cm (½ in.) from the bottom of the flask. The second impinger is of the Greensburg-Smith design with the standard tip.

5.1.8 Metering system—Vacuum gauge, leak-free pump, thermometers capable of measuring temperature to within 3°C (~5°F), dry gas meter with 2% accuracy at the required sampling rate, and related equipment, or equivalent, as required to maintain an isokinetic sampling rate and to determine sample volume. When the metering system is used in conjunction with a pitot tube, the system shall enable checks of isokinetic rates.

5.1.9 Barometer—Mercury, aneroid, or other barometers capable of measuring atmospheric pressure to within 2.5 mm Hg (0.1 in. Hg). In many cases, the barometric reading may be obtained from a nearby weather bureau station, in which case the station value shall be requested and an adjustment for elevation differences shall be applied at a rate of minus 2.5 mm Hg (0.1 in. Hg) per 30 m (100 ft) elevation increase.

5.2 *Sample recovery.*

5.2.1 Probe liner and probe nozzle brushes—Nylon bristles with stainless steel wire handles. The probe brush shall have extensions, at least as long as the probe, of stainless steel, teflon, or similarly inert material. Both brushes shall be properly sized and shaped to brush out the probe liner and nozzle.

5.2.2 Glass wash bottles—Two.

5.2.3 Sample storage containers—Wide mouth, high density polyethylene bottles, 1 liter.

5.2.4 Plastic storage containers—Air tight containers of sufficient volume to store silica gel.

5.2.5 Graduated cylinder—250 ml.

5.2.6 Funnel and rubber policeman—to aid in transfer of silica gel to container; not necessary if silica gel is weighed in the field.

5.3 *Analysis.*

5.3.1 Distillation apparatus—Glass distillation apparatus assembled as shown in Figure 13A–2.

5.3.2 Hot plate—Capable of heating to 500° C.

5.3.3 Electric muffle furnace—Capable of heating to 600° C.

5.3.4 Crucibles—Nickel, 75 to 100 ml capacity.

5.3.5 Beaker, 1500 ml.

5.3.6 Volumetric flask—50 ml.

5.3.7 Erlenmeyer flask or plastic bottle—500 ml.

5.3.8 Constant temperature bath—Capable of maintaining a constant temperature of ±1.0° C in the range of room temperature.

5.3.9 Balance—300 g capacity to measure to ±0.5 g.

5.3.10 Spectrophotometer — Instrument capable of measuring absorbance at 570 nm and providing at least a 1 cm light path.

5.3.11 Spectrophotometer cells—1 cm.

6. *Reagents*

6.1 *Sampling.*

6.1.1 Filters—Whatman No. 1 filters, or equivalent, sized to fit filter holder.

6.1.2 Silica gel—Indicating type, 6-16 mesh. If previously used, dry at 175° C (350° F) for 2 hours. New silica gel may be used as received.

6.1.3 Water—Distilled.

6.1.4 Crushed ice.

6.1.5 Stopcock grease—Acetone insoluble, heat stable silicone grease. This is not necessary if screw-on connectors with teflon sleeves, or similar, are used.

6.2 *Sample recovery.*

6.2.1 Water—Distilled from same container as 6.1.3.

6.3 *Analysis.*

6.3.1 Calcium oxide (CaO)—Certified grade containing 0.005 percent fluoride or less.

6.3.2 Phenolphthalein Indicator—0.1 percent in 1:1 ethanol-water mixture.

6.3.3 Silver sulfate (Ag_2SO_4)—ACS reagent grade, or equivalent.

6.3.4 Sodium hydroxide (NaOH)—Pellets, ACS reagent grade, or equivalent.

6.3.5 Sulfuric acid (H_2SO_4)—Concentrated, ACS reagent grade, or equivalent.

6.3.6 Filters—Whatman No. 541, or equivalent.

6.3.7 Hydrochloric acid (HCl)—Concentrated, ACS reagent grade, or equivalent.

6.3.8 Water—Distilled, from same container as 6.1.3.

6.3.9 Sodium fluoride—Standard solution. Dissolve 0.2210 g of sodium fluoride in 1 liter of distilled water. Dilute 100 ml of this solution to 1 liter with distilled water. One milliliter of the solution contains 0.01 mg of fluoride.

6.3.10 SPADNS solution—[4,5dihydroxy-3-(p-sulfophenylazo)-2,7-naphthalene - disulfonic acid trisodium salt]. Dissolve 0.960 ±.010 g of SPADNS reagent in 500 ml distilled water. This solution is stable for at least one month, if stored in a well-sealed bottle protected from sunlight.

6.3.11 Reference solution—Add 10 ml of SPADNS solution (6.3.10) to 100 ml distilled water and acidify with a solution prepared by diluting 7 ml of concentrated HCl to 10 ml with distilled water. This solution is used to set the spectrophotometer zero point and should be prepared daily.

6.3.12 SPADNS Mixed Reagent—Dissolve 0.135 ±0.005 g of zirconyl chloride octahydrate ($ZrOCl_2 \cdot 8H_2O$), in 25 ml distilled water. Add 350 ml of concentrated HCl and dilute to 500 ml with distilled water. Mix equal volumes of this solution and SPADNS solution to form a single reagent. This reagent is stable for at least two months.

7. *Procedure.*

NOTE: The fusion and distillation steps of this procedure will not be required, if it can be shown to the satisfaction of the Administrator that the samples contain only water-soluble fluorides.

7.1 *Sampling.* The sampling shall be conducted by competent personnel experienced with this test procedure.

7.1.1 Pretest preparation. All train components shall be maintained and calibrated according to the procedure described in APTD–0576, unless otherwise specified herein.

Weigh approximately 200–300 g of silica gel in air tight containers to the nearest 0.5 g. Record the total weight, both silica gel and container, on the container. More silica gel may be used but care should be taken during sampling that it is not entrained and carried out from the impinger. As an alternative, the silica gel may be weighed directly in the impinger or its sampling holder just prior to the train assembly.

7.1.2 Preliminary determinations. Select the sampling site and the minimum number of sampling points according to Method 1 or as specified by the Administrator. Determine the stack pressure, temperature, and the range of velocity heads using Method 2 and moisture content using Approximation Method 4 or its alternatives for the purpose of making isokinetic sampling rate calculations. Estimates may be used. However, final results will be based on actual measurements made during the test.

Select a nozzle size based on the range of velocity heads such that it is not necessary to change the nozzle size in order to maintain isokinetic sampling rates. During the run, do not change the nozzle size. Ensure that the differential pressure gauge is capable of measuring the minimum velocity head value to within 10%, or as specified by the Administrator.

Select a suitable probe liner and probe length such that all traverse points can be sampled. Consider sampling from opposite sides for large stacks to reduce the length of probes.

Select a total sampling time greater than or equal to the minimum total sampling time specified in the test procedures for the specific industry such that the sampling time per point is not less than 2 min. or select some greater time interval as specified by the Administrator, and such that the sample volume that will be taken will exceed the required minimum total gas sample volume specified in the test procedures for the specific industry. The latter is based on an approximate average sampling rate. Note also that the minimum total sample volume is corrected to standard conditions.

It is recommended that a half-integral or integral number of minutes be sampled at each point in order to avoid timekeeping errors.

In some circumstances, e.g. batch cycles, it may be necessary to sample for shorter times at the traverse points and to obtain smaller gas sample volumes. In these cases, the Administrator's approval must first be obtained.

7.1.3 Preparation of collection train. During preparation and assembly of the sampling train, keep all openings where contamination can occur covered until just prior to assembly or until sampling is about to begin.

Place 100 ml of water in each of the first two impingers, leave the third impinger empty, and place approximately 200–300 g or more, if necessary, of preweighed silica gel in the fourth impinger. Record the weight of the silica gel and container on the data sheet. Place the empty container in a clean place for later use in the sample recovery.

Place a filter in the filter holder. Be sure that the filter is properly centered and the gasket properly placed so as to not allow the sample gas stream to circumvent the filter. Check filter for tears after assembly is completed.

When glass liners are used, install selected nozzle using a Viton A O-ring; the Viton A O-ring is installed as a seal where the nozzle is connected to a glass liner. See APTD-0576 for details. When metal liners are used, install the nozzle as above or by a leak free direct mechanical connection. Mark the probe with heat resistant tape or by some other method to denote the proper distance into the stack or duct for each sampling point.

Unless otherwise specified by the Administrator, attach a temperature probe to the metal sheath of the sampling probe so that the sensor extends beyond the probe tip and does not touch any metal. Its position should be about 1.9 to 2.54 cm (0.75 to 1 in.) from the pitot tube and probe nozzle to avoid interference with the gas flow.

Assemble the train as shown in Figure 13A-1 with the filter between the third and fourth impingers. Alternatively, the filter may be placed between the probe and the first impinger. A filter heating system may be used to prevent moisture condensation, but the temperature around the filter holder shall not exceed 120±14°C (248±25°F). [(Note: Whatman No. 1 filter decomposes at 150°C (300°F)).] Record filter location on the data sheet.

Place crushed ice around the impingers.

7.14 Leak check procedure—After the sampling train has been assembled, turn on and set (if applicable) the probe and filter heating system(s) to reach a temperature sufficient to avoid condensation in the probe. Allow time for the temperature to stabilize. Leak check the train at the sampling site by plugging the nozzle and pulling a 380 mm Hg (15 in. Hg) vacuum. A leakage rate in excess of 4% of the average sampling rate or 0.00057 m^3/min. (0.02 cfm), whichever is less, is unacceptable.

The following leak check instructions for the sampling train described in APTD-0576 and APTD-0581 may be helpful. Start the pump with by-pass valve fully open and coarse adjust valve completely closed. Partially open the coarse adjust valve and slowly close the by-pass valve until 380 mm Hg (15 in. Hg) vacuum is reached. *Do not* reverse direction of by-pass valve. This will cause water to back up into the filter holder. If 380 mm Hg (15 in. Hg) is exceeded, either leak check at this higher vacuum or end the leak check as described below and start over.

When the leak check is completed, first slowly remove the plug from the inlet to the probe or filter holder and immediately turn off the vacuum pump. This prevents the water in the impingers from being forced backward into the filter holder (if placed before the impingers) and silica gel from being entrained backward into the third impinger.

Leak checks shall be conducted as described whenever the train is disengaged, e.g. for silica gel or filter changes during the test, prior to each test run, and at the completion of each test run. If leaks are found to be in excess of the acceptable rate, the test will be considered invalid. To reduce lost time due to leakage occurrences, it is recommended that leak checks be conducted between port changes.

7.1.5 Particulate train operation—During the sampling run, an isokinetic sampling rate within 10%, or as specified by the Administrator, of true isokinetic shall be maintained.

For each run, record the data required on the example data sheet shown in Figure 13A-3. Be sure to record the initial dry gas meter reading. Record the dry gas meter readings at the beginning and end of each sampling time increment, when changes in flow rates are made, and when sampling is halted. Take other data point readings at least once at each sample point during each time increment and additional readings when significant changes (20% variation in velocity head readings) necessitate additional adjustments in flow rate. Be sure to level and zero the manometer.

Clean the portholes prior to the test run to minimize chance of sampling deposited material. To begin sampling, remove the nozzle cap, verify (if applicable) that the probe heater is working and filter heater is up to temperature, and that the pitot tube and probe are properly positioned. Position the nozzle at the first traverse point with the tip pointing directly into the gas stream. Immediately start the pump and adjust the flow to isokinetic conditions. Nomographs are available for sampling trains using type S pitot tubes with 0.85±0.02 coefficients (C_p), and when sampling in air or a stack gas with equivalent density (molecular weight, M_d, equal to 29±4), which aid in the rapid adjustment of the isokinetic sampling rate without excessive computations. APTD-0576 details the procedure for using these nomographs. If C_p and M_d are outside the above stated ranges, do not use the nomograph unless appropirate steps are taken to compensate for the deviations.

When the stack is under significant negative pressure (height of impinger stem), take care to close the coarse adjust valve before inserting the probe into the stack to avoid water backing into the filter holder. If necessary, the pump may be turned on with the coarse adjust valve closed.

When the probe is in position, block off the openings around the probe and porthole to prevent unrepresentative dilution of the gas stream.

Traverse the stack cross section, as required by Method 1 or as specified by the Administrator, being careful not to bump the probe nozzle into the stack walls when sampling near the walls or when removing or inserting the probe through the portholes to minimize chance of extracting deposited material.

During the test run, make periodic adjustments to keep the probe and (if applicable) filter temperatures at their proper values. Add more ice and, if necessary, salt to the ice bath, to maintain a temperature of less than 20°C (68°F) at the impinger/silica gel outlet, to avoid excessive moisture losses. Also, periodically check the level and zero of the manometer.

If the pressure drop across the filter becomes high enough to make isokinetic sampling difficult to maintain, the filter may be replaced in the midst of a sample run. It is recommended that another complete filter assembly be used rather than attempting to change the filter itself. After the new filter or filter assembly is installed conduct a leak check. The final emission results shall be based on the summation of all filter catches.

A single train shall be used for the entire sample run, except for filter and silica gel changes. However, if approved by the Administrator, two or more trains may be used for a single test run when there are two or more ducts or sampling ports. The final emission results shall be based on the total of all sampling train catches.

At the end of the sample run, turn off the pump, remove the probe and nozzle from the stack, and record the final dry gas meter reading. Perform a leak check.[1] Calculate percent isokinetic (see calculation section) to determine whether another test run should be made. If there is difficulty in maintaining isokinetic rates due to source conditions, consult with the Administrator for possible variance on the isokinetic rates.

7.2 Sample recovery. Proper cleanup procedure begins as soon as the probe is removed from the stack at the end of the sampling period.

When the probe can be safely handled, wipe off all external particulate matter near the tip of the probe nozzle and place a cap over it to keep from losing part of the sample. Do not cap off the probe tip tightly while the sampling train is cooling down, as this would create a vacuum in the filter holder, thus drawing water from the impingers into the filter.

Before moving the sample train to the cleanup site, remove the probe from the sample train, wipe off the silicone grease, and cap the open outlet of the probe. Be careful not to lose any condensate, if present. Wipe off the silicone grease from the filter inlet where the probe was fastened and cap it. Remove the umbilical cord from the last impinger and cap the impinger. After wiping off the silicone grease, cap off the filter holder outlet and impinger inlet. Ground glass stoppers, plastic caps, or serum caps may be used to close these openings.

Transfer the probe and filter-impinger assembly to the cleanup area. This area should be clean and protected from the wind so that the chances of contaminating or losing the sample will be minimized.

Inspect the train prior to and during disassembly and note any abnormal conditions. Using a graduated cylinder, measure and record the volume of the water in the first three impingers, to the nearest ml; any condensate in the probe should be included in this determination. Treat the samples as follows:

7.2.1 Container No. 1. Transfer the impinger water from the graduated cylinder to this container. Add the filter to this container. Wash all sample exposed surfaces, including the probe tip, probe, first three impingers, impinger connectors, filter holder, and graduated cylinder thoroughly with distilled water. Wash each component three separate times with water and clean the probe and nozzle with brushes. A maximum wash of 500 ml is used, and the washings are added to the sample container which must be made of polyethylene.

7.2.2 Container No. 2. Transfer the silica gel from the fourth impinger to this container and seal.

7.3 *Analysis*. Treat the contents of each sample container as described below.

7.3.1 Container No. 1.

7.3.1.1 Filter this container's contents, including the Whatman No. 1 filter, through Whatman No. 541 filter paper, or equivalent into a 1500 ml beaker. Note: If filtrate volume exceeds 900 ml make filtrate basic with NaOH to phenolphthalein and evaporate to less than 900 ml.

7.3.1.2 Place the Whatman No. 541 filter containing the insoluble matter (including the Whatman No. 1 filter) in a nickel crucible, add a few ml of water and macerate the filter with a glass rod.

Add 100 mg CaO to the crucible and mix the contents thoroughly to form a slurry. Add a couple of drops of phenolphthalein indicator. The indicator will turn red in a basic medium. The slurry should remain basic during the evaporation of the water or fluoride ion will be lost. If the indicator turns colorless during the evaporation, an acidic condition is indicated. If this happens add CaO until the color turns red again.

Place the crucible in a hood under infrared lamps or on a hot plate at low heat. Evaporate the water completely.

After evaporation of the water, place the crucible on a hot plate under a hood and slowly increase the temperature until the paper chars. It may take several hours for complete charring of the filter to occur.

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[1] With acceptability of the test run to be based on the same criterion as in 7.1.4.

Place the crucible in a cold muffle furnace and gradually (to prevent smoking) increase the temperature to 600°C, and maintain until the contents are reduced to an ash. Remove the crucible from the furnace and allow it to cool.

7.3.1.3 Add approximately 4 g of crushed NaOH to the crucible and mix. Return the crucible to the muffle furnace, and fuse the sample for 10 minutes at 600°C.

Remove the sample from the furnace and cool to ambient temperature. Using several rinsings of warm distilled water transfer the contents of the crucible to the beaker containing the filtrate from container No. 1 (7.3.1). To assure complete sample removal, rinse finally with two 20 ml portions of 25 percent (v/v) sulfuric acid and carefully add to the beaker. Mix well and transfer a one-liter volumetric flask. Dilute to volume with distilled water and mix thoroughly. Allow any undissolved solids to settle.

7.3.2 Container No. 2. Weigh the spent silica gel and report to the nearest 0.5 g.

7.3.3 Adjustment of acid/water ratio in distillation flask—(Utilize a protective shield when carrying out this procedure.) Place 400 ml of distilled water in the distilling flask and add 200 ml of concentrated H_2SO_4. Caution: Observe standard precautions when mixing the H_2SO_4 by slowly adding the acid to the flask with constant swirling. Add some soft glass beads and several small pieces of broken glass tubing and assemble the apparatus as shown in Figure 13A-2. Heat the flask until it reaches a temperature of 175°C to adjust the acid/water ratio for subsequent distillations. Discard the distillate.

7.3.4 Distillation—Cool the contents of the distillation flask to below 80°C. Pipette an aliquot of sample containing less than 0.6 mg F directly into the distilling flask and add distilled water to make a total volume of 220 ml added to the distilling flask. [For an estimate of what size aliquot does not exceed 0.6 mg F, select an aliquot of the solution and treat as described in Section 7.3.6. This will give an approximation of the fluoride content, but only an approximation since interfering ions have not been removed by the distillation step.]

Place a 250 ml volumetric flask at the condenser exit. Now begin distillation and gradually increase the heat and collect all the distillation up to 175°C. Caution: Heating the solution above 175°C will cause sulfuric acid to distill over.

The acid in the distilling flask can be used until there is carryover of interferences or poor fluoride recovery. An occasional check of fluoride recovery with standard solutions is advised. The acid should be changed whenever there is less than 90 percent recovery or blank values are higher than 0.1 μg/ml. Note: If the sample contains chloride, add 5 mg Ag_2SO_4 to the flask for every mg of chloride. Gradually increase the heat and collect at the distillate up to 175°C. Do not exceed 175°C.

7.3.5 Determination of Concentration—Bring the distillate in the 250 ml volumetric flask to the mark with distilled water and mix thoroughly. Pipette a suitable aliquot from the distillate (containing 10 μg to 40 μg fluoride) and dilute to 50 ml with distilled water. Add 10 ml of SPADNS Mixed Reagent (see Section 6.3.12) and mix thoroughly.

After mixing, place the sample in a constant temperature bath containing the standard solution for thirty minutes before reading the absorbance with the spectrophotometer.

Set the spectrophotometer to zero absorbance at 570 nm with reference solution (6.3.11), and check the spectrophotometer calibration with the standard solution. Determine the absorbance of the samples and determine the concentration from the calibration curve. If the concentration does not fall within the range of the calibration curve, repeat the procedure using a different size aliquot.

8. *Calibration*.

Maintain a laboratory log of all calibrations.

8.1 Sampling Train.

8.1.1 Probe nozzle—Using a micrometer, measure the inside diameter of the nozzle to the nearest 0.025 mm (0.001 in.). Make 3 separate measurements using different diameters each time and obtain the average of the measurements. The difference between the high and low numbers shall not exceed 0.1 mm (0.004 in.).

When nozzles become nicked, dented, or corroded, they shall be reshaped, sharpened, and recalibrated before use.

Each nozzle shall be permanently and uniquely identified.

8.1.2 Pitot tube—The pitot tube shall be calibrated according to the procedure outlined in Method 2.

8.1.3 Dry gas meter and orifice meter. Both meters shall be calibrated according to the procedure outlined in APTD-0576. When diaphragm pumps with by-pass valves are used, check for proper metering system design by calibrating the dry gas meter at an additional flow rate of 0.0057 m^3/min. (0.2 cfm) with the by-pass valve fully opened and then with it fully closed. If there is more than ±2 percent difference in flow rates when compared to the fully closed position of the by-pass valve, the system is not designed properly and must be corrected.

8.1.4 Probe heater calibration—The probe heating system shall be calibrated according to the procedure contained in APTD-0576. Probes constructed according to APTD-0581 need not be calibrated if the calibration curves in APTD-0576 are used.

8.1.5 Temperature gauges—Calibrate dial and liquid filled bulb thermometers against mercury-in-glass thermometers. Thermocouples need not be calibrated. For other devices, check with the Administrator.

8.2 Analytical Apparatus. Spectrophotometer. Prepare the blank standard by adding 10 ml of SPADNS mixed reagent to 50 my of distilled water. Accurately prepare a series of standards from the standard fluoride solution (see Section 6.3.9) by diluting 2, 4, 6, 8, 10, 12, and 14 ml volumes to 100 ml with distilled water. Pipette 50 ml from each solution and transfer to a 100 ml beaker. Then add 10 ml of SPADNS mixed reagent to each. These standards will contain 0, 10, 20, 30, 40, 50, 60, and 70 μg of fluoride (0—1.4 μg/ml) respectively.

After mixing, place the reference standards and reference solution in a constant temperature bath for thirty minutes before reading the absorbance with the spectrophotometer. All samples should be adjusted to this same temperature before analyzing. Since a 3°C temperature difference between samples and standards will produce an error of approximately 0.005 mg F/liter, care must be taken to see that samples and standards are at nearly identical temperatures when absorbances are recorded.

With the spectrophotometer at 570 nm, use the reference solution (see section 6.3.11) to set the absorbance to zero.

Determine the absorbance of the standards. Prepare a calibration curve by plotting μg F/50 ml versus absorbance on linear graph paper. A standard curve should be prepared initially and thereafter whenever the SPADNS mixed reagent is newly made. Also, a calibration standard should be run with each set of samples and if it differs from the calibration curve by ±2 percent, a new standard curve should be prepared.

9. *Calculations*.

Carry out calculations, retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after final calculation.

9.1 Nomenclature.

A_d = Aliquot of distillate taken for color development, ml.

A_n = Cross sectional area of nozzle, m^2 (ft^2).

A_t = Aliquot of total sample added to still, ml.

B_{ws} = Water vapor in the gas stream, proportion by volume.

C_s = Concentration of fluoride in stack gas, mg/m^3, corrected to standard conditions of 20° C, 760 mm Hg (68° F, 29.92 in. Hg) on dry basis.

F_t = Total weight of fluoride in sample, mg.

μgF = Concentration from the calibration curve, μg.

I = Percent of isokinetic sampling.

m_n = Total amount of particulate matter collected, mg.

M_w = Molecular weight of water, 18 g/g-mole (18 lb/lb-mole).

m_a = Mass of residue of acetone after evaporation, mg.

P_{bar} = Barometric pressure at the sampling site, mm Hg (in. Hg).

P_s = Absolute stack gas pressure, mm Hg (in. Hg).

P_{std} = Standard absolute pressure, 760 mm Hg (29.92 in. Hg).

R = Ideal gas constant, 0.06236 mm Hg-m^3/°K-g-mole (21.83 in. Hg-ft^3/°R-lb-mole).

T_m = Absolute average dry gas meter temperature (see fig. 13A-3), °K (°R).

T_s = Absolute average stack gas temperature (see fig. 13A-3), °K (°R).

T_{std} = Standard absolute temperature, 293° K (528° R).

V_a = Volume of acetone blank, ml.

V_{aw} = Volume of acetone used in wash, ml.

V_d = Volume of distillate collected, ml.

V_{lc} = Total volume of liquid collected in impingers and silica gel, ml. Volume of water in silica gel equals silica gel weight increase in grams times 1 ml/gram. Volume of liquid collected in impinger equals final volume minus initial volume.

V_m = Volume of gas sample as measured by dry gas meter, dcm (dcf).

$V_{m(std)}$ = Volume of gas sample measured by the dry gas meter corrected to standard conditions, dscm (dscf).

$V_{w(std)}$ = Volume of water vapor in the gas sample corrected to standard conditions, scm (scf).

V_t = Total volume of sample, ml.

v_s = Stack gas velocity, calculated by Method 2, Equation 2-7 using data obtained from Method 5, m/sec (ft/sec).

W_a = Weight of residue in acetone wash, mg.

ΔH = Average pressure differential across the orifice (see fig. 13A-3), meter, mm H_2O (in. H_2O).

ρ_a = Density of acetone, mg/ml (see label on bottle).

ρ_w = Density of water, 1 g/ml (0.00220 lb/ml).

θ = Total sampling time, min.

13.6 = Specific gravity of mercury.

60 = Sec/min.

100 = Conversion to percent.

9.2 Average dry gas meter temperature and average orifice pressure drop. See data sheet (fig. 13A-3).

9.3 Dry gas volume. Correct the sample volume measured by the dry gas meter to standard conditions [20° C, 760 mm Hg (68° F, 20.92 inches Hg)] by using equation 13A-1.

$$V_{m(std)}=V_m\frac{T_{std}}{T_m}\left[\frac{P_{bar}+\frac{\Delta H}{13.6}}{P_{std}}\right]=KV_m\frac{P_{bar}+\Delta H/13.6}{T_m}$$

equation 13A-1

where:
$K=0.3855$ °K/mm Hg for metric units.
$=17.65$ °R/in. Hg for English units.

9.4 Volume of water vapor.

$$V_{w(std)}=V_{lc}\frac{\rho_w}{M_w}\frac{RT_{std}}{P_{std}}=KV_{lc}$$

equation 13A-2

where:
$K=0.00134$ m³/ml for metric units.
$=0.0472$ ft³/ml for English units.

9.5 Moisture content.

$$B_{ws}=\frac{V_{w(std)}}{V_{m(std)}+V_{w(std)}}$$

equation 13A-3

If the liquid droplets are present in the gas stream assume the stream to be saturated and use a psychrometric chart to obtain an approximation of the moisture percentage.

9.6 Concentration.

9.6.1 Calculate the amount of fluoride in the sample according to Equation 13A-4.

$$F_t=K\frac{V_t}{A_t}\frac{V_d}{A_d}\ (\mu g\ F)$$

equation 13A-4

where:
$K=10^{-3}$ mg/μg.

9.6.2 Concentration of fluoride in stack gas. Determine the concentration of fluoride in the stack gas according to Equation 13A-5.

$$C_s=K\frac{F_t}{V_{m(std)}}$$

equation 13A-5

where:
$K=35.31$ ft³/m³.

9.7 Isokinetic variation.

9.7.1 Calculations from raw data.

$$I=\frac{100\ T_s\left[KV_{lc}+(V_m/T_m)\ (P_{bar}+\Delta H/13.6)\right]}{60\ \theta v_s P_s A_n}$$

equation 13A-6

where:
$K=0.00346$ mm Hg-m³/ml-°K for metric units.
$=0.00267$ in. Hg-ft³/ml-°R for English units.

9.7.2 Calculations from intermediate values.

$$I=\frac{T_s V_{m(std)} P_{std}\ 100}{T_{std} v_s \theta A_n P_s\ 60\ (1-B_{ws})}$$

$$=K\frac{T_s V_{m(std)}}{P_s v_s A_n \theta\ (1-B_{ws})}$$

equation 13A-7

where:
$K=4.323$ for metric units.
$=0.0944$ for English units.

9.8 Acceptable results. The following range sets the limit on acceptable isokinetic sampling results:

If 90 percent $<I<$ 110 percent, the results are acceptable. If the results are low in comparison to the standards and I is beyond the acceptable range, the Administrator may option to accept the results. Use reference 7.4 to make judgments. Otherwise, reject the results and repeat the test.

10. *References.*

Bellack, Ervin, "Simplified Fluoride Distillation Method," *Journal of the American Water Works Association* #50: 530–6 (1958).

MacLeod, Kathryn E., and Howard L. Crist, "Comparison of the SPADNS—Zirconium Lake and Specific Ion Electrode Methods of Fluoride Determination in Stack Emission Samples," *Analytical Chemistry* 45: 1272–1273 (1973).

Martin, Robert M., "Construction Details of Isokinetic Source Sampling Equipment," Environmental Protection Agency, Air Pollution Control Office Publication No. APTD–0581.

1973 Annual Book of ASTM Standards, Part 23, Designation: D 1179–72.

Rom, Jerome J., "Maintenance, Calibration, and Operation of Isokinetic Source Sampling Equipment," Environmental Protection Agency, Air Pollution Control Office Publication No. APTD–0576.

Standard Methods for the Examination of Water and Waste Water, published jointly by American Public Health Association, American Water Works Association and Water Pollution Control Federation, 13th Edition (1971).

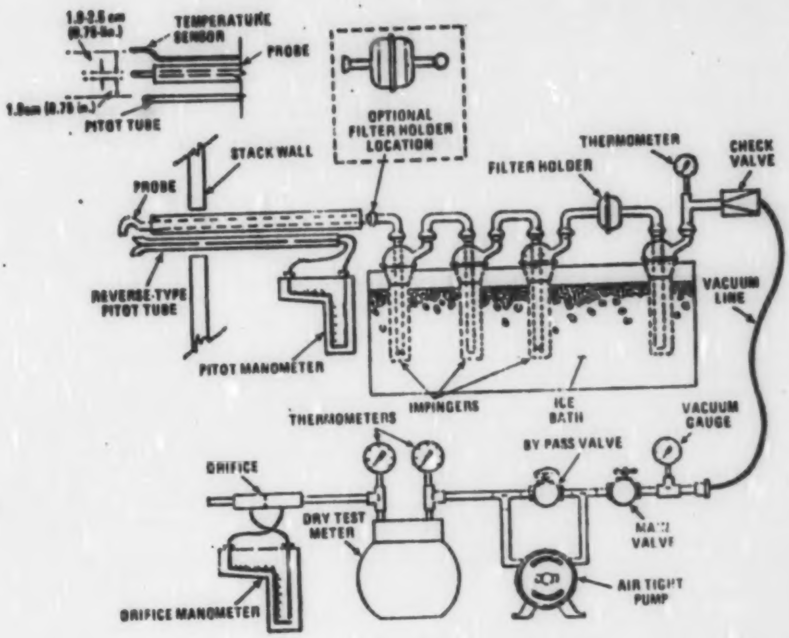
1.9-2.5 cm
(0.75-in.)
TEMPERATURE
SENSOR
PROBE
1.9cm (0.75 in.)
PITOT TUBE
OPTIONAL
FILTER HOLDER
LOCATION
STACK WALL
PROBE
REVERSE-TYPE
PITOT TUBE
PITOT MANOMETER
THERMOMETER
CHECK
VALVE
FILTER HOLDER
VACUUM
LINE
IMPINGERS
ICE
BATH
THERMOMETERS
VACUUM
GAUGE
BY PASS VALVE
ORIFICE
DRY TEST
METER
MAIN
VALVE
AIR TIGHT
PUMP
ORIFICE MANOMETER

Figure 13A-1. Fluoride sampling train.

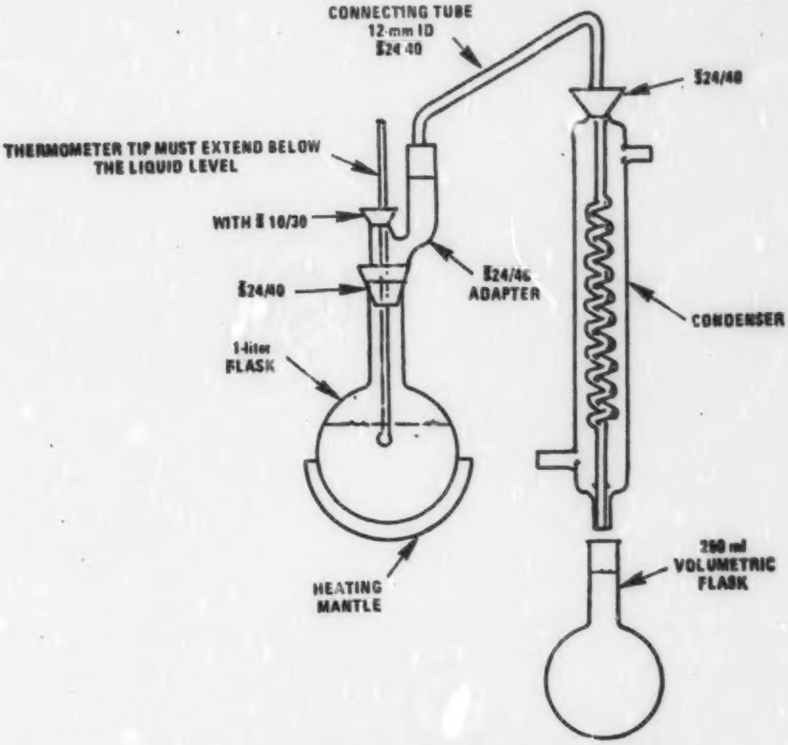
CONNECTING TUBE
12 mm ID
§24/40
§24/40
THERMOMETER TIP MUST EXTEND BELOW
THE LIQUID LEVEL
WITH § 10/30
§24/40
§24/40
ADAPTER
CONDENSER
1-liter
FLASK
250 ml
VOLUMETRIC
FLASK
HEATING
MANTLE

Figure 13A-2. Fluoride Distillation Apparatus

PLANT ______________
LOCATION ______________
OPERATOR ______________
DATE ______________
RUN NO. ______________
SAMPLE BOX NO. ______________
METER BOX NO. ______________
METER ΔH@ ______________
C FACTOR ______________
PITOT TUBE COEFFICIENT, C_p ______________

SCHEMATIC OF STACK CROSS SECTION

AMBIENT TEMPERATURE ______________
BAROMETRIC PRESSURE ______________
ASSUMED MOISTURE, % ______________
PROBE LENGTH, m (ft) ______________
NOZZLE IDENTIFICATION NO. ______________
AVERAGE CALIBRATED NOZZLE DIAMETER, cm (in.) ______________
PROBE HEATER SETTING ______________
LEAK RATE, m³/min (cfm) ______________
PROBE LINER MATERIAL ______________

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min.	STATIC PRESSURE mm Hg (in Hg)	STACK TEMPERATURE (T_S) °C (°F)	VELOCITY HEAD (ΔP_S),	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER mm H_2O (in. H_2O)	GAS SAMPLE VOLUME m³ (ft³)	GAS SAMPLE TEMPERATURE AT DRY GAS METER		FILTER HOLDER TEMPERATURE, °C (°F)	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER, °C (°F)
							INLET °C (°F)	OUTLET °C (°F)		
TOTAL							Avg.	Avg.		
AVERAGE							Avg.			

Figure 13A-3. Field data.

METHOD 13B—DETERMINATION OF TOTAL FLUORIDE EMISSIONS FROM STATIONARY SOURCES—SPECIFIC ION ELECTRODE METHOD.

1. *Principle and Applicability.*

1.1 Principle. Gaseous and particulate fluorides are withdrawn isokinetically from the source using a sampling train. The fluorides are collected in the impinger water and on the filter of the sampling train. The weight of total fluorides in the train is determined by the specific ion electrode method.

1.2 Applicability. This method is applicable for the determination of fluoride emissions from stationary sources only when specified by the test procedures for determining compliance with new source performance standards. Fluorocarbons such as Freons, are not quantitatively collected or measured by this procedure.

2. *Range and Sensitivity.*

The fluoride specific ion electrode analytical method covers the range of 0.02–2,000 μg F/ml; however, measurements of less than 0.1 μg F/ml require extra care. Sensitivity has not been determined.

3. *Interferences.*

During the laboratory analysis, aluminum in excess of 300 mg/liter and silicon dioxide in excess of 300 μg/liter will prevent complete recovery of fluoride.

4. *Precision, Accuracy and Stability.*

The accuracy of fluoride electrode measurements has been reported by various researchers to be in the range of 1-5 percent in a concentration range of 0.04 to 80 mg/l. A change in the temperature of the sample will change the electrode response; a change of 1°C will produce a 1.5 percent relative error in the measurement. Lack of stability in the electrometer used to measure EMF can introduce error. An error of 1 millivolt in the EMF measurement produces a relative error of 4 percent regardless of the absolute concentration being measured.

5. *Apparatus.*

5.1 Sample train. See Figure 13A-1 (Method 13A); it is similar to the Method 5 train except for the interchangeability of the position of the filter. Commercial models of this train are available. However, if one desires to build his own, complete construction details are described in APTD-0581; for changes from the APTD-0581 document and for allowable modifications to Figure 13A-1, see the following subsections.

The operating and maintenance procedures for the sampling train are described in APTD-0576. Since correct usage is important in obtaining valid results, all users should read the APTD-0576 document and adopt the operating and maintenance procedures outlined in it, unless otherwise specified herein.

5.1.1 Probe nozzle—Stainless steel (316) with sharp, tapered leading edge. The angle of taper shall be ≦30° and the taper shall be on the outside to preserve a constant internal diameter. The probe nozzle shall be of the button-hook or elbow design, unless otherwise specified by the Administrator. The wall thickness of the nozzle shall be less than or equal to that of 20 gauge tubing, i.e., 0.165 cm (0.065 in.) and the distance from the tip of the nozzle to the first bend or point of disturbance shall be at least two times the outside nozzle diameter. The nozzle shall be constructed from seamless stainless steel tubing. Other configurations and construction material may be used with approval from the Administrator.

A range of sizes suitable for isokinetic sampling should be available, e.g., 0.32 cm (⅛ in.) up to 1.27 cm (½ in.) (or larger if higher volume sampling trains are used) inside diameter (ID) nozzles in increments of 0.16 cm (1/16 in.). Each nozzle shall be calibrated according to the procedures outlined in the calibration section.

5.1.2 Probe liner—Borosilicate glass or stainless steel (316). When the filter is located immediately after the probe, a probe heating system may be used to prevent filter plugging resulting from moisture condensation. The temperature in the probe shall not exceed 120±14°C (248±25°F).

5.1.3 Pitot tube—Type S, or other device approved by the Administrator, attached to probe to allow constant monitoring of the stack gas velocity. The face openings of the pitot tube and the probe nozzle shall be adjacent and parallel to each other, not necessarily on the same plane, during sampling. The free space between the nozzle and pitot tube shall be at least 1.9 cm (0.75 in.). The free space shall be set based on a 1.3 cm (0.5 in.) ID nozzle, which is the largest size nozzle used.

The pitot tube must also meet the criteria specified in Method 2 and be calibrated according to the procedure in the calibration section of that method.

5.1.4 Differential pressure gauge—Inclined manometer capable of measuring velocity head to within 10 percent of the minimum measured value. Below a differential pressure of 1.3 mm (0.05 in.) water gauge, micromanometers with sensitivities of 0.013 mm (0.0005 in.) should be used. However, micromanometers are not easily adaptable to field conditions and are not easy to use with pulsating flow. Thus, other methods or devices acceptable to the Administrator may be used when conditions warrant.

5.1.5 Filter holder—Borosilicate glass with a glass frit filter support and a silicone rubber gasket. Other materials of construction may be used with approval from the Administrator, e.g. if probe liner is stainless steel, then filter holder may be stainless steel. The holder design shall provide a positive seal against leakage from the outside or around the filter.

5.1.6 Filter heating system—When moisture condensation is a problem, any heating system capable of maintaining a temperature around the filter holder during sampling of no greater than 120±14°C (248±25°F). A temperature gauge capable of measuring temperature to within 3°C (5.4°F) shall be installed so that when the filter heater is used, the temperature around the filter holder can be regulated and monitored during sampling. Heating systems other than the one shown in APTD-0581 may be used.

5.1.7 Impingers—Four impingers connected as shown in Figure 13A-1 with ground glass (or equivalent), vacuum tight fittings. The first, third, and fourth impingers are of the Greenburg-Smith design, modified by replacing the tip with a 1¼ cm (½ in.) inside diameter glass tube extending to 1¼ cm (½ in.) from the bottom of the flask. The second impinger is of the Greenburg-Smith design with the standard tip.

5.1.8 Metering system—Vacuum gauge, leak-free pump, thermometers capable of measuring temperature to within 3°C (~.5°F), dry gas meter with 2 percent accuracy at the required sampling rate, and related equipment, or equivalent, as required to maintain an isokinetic sampling rate and to determine sample volume. When the metering system is used in conjunction with a pitot tube, the system shall enable checks of isokinetic rates.

5.1.9 Barometer—Mercury, aneroid, or other barometers capable of measuring atmospheric pressure to within 2.5 mm Hg (0.1 in Hg). In many cases, the barometric reading may be obtained from a nearby weather bureau station, in which case the station value shall be requested and an adjustment for elevation differences shall be applied at a rate of minus 2.5 mm Hg (0.1 in. Hg) per 30 m (100 ft) elevation increase.

5.2 Sample recovery.

5.2.1 Probe liner and probe nozzle brushes—Nylon bristles with stainless steel wire handles. The probe brush shall have extensions, at least as long as the probe, of stainless steel, teflon, or similarly inert material. Both brushes shall be properly sized and shaped to brush out the probe liner and nozzle.

5.2.2 Glass wash bottles—Two.

5.2.3 Sample storage containers—Wide mouth, high density polyethylene bottles, 1 liter.

5.2.4 Plastic storage containers—Air tight containers of sufficient volume to store silica gel.

5.2.5 Graduated cylinder—250 ml.

5.2.6 Funnel and rubber policeman—To aid in transfer of silica gel to container; not necessary if silica gel is weighed in the field.

5.3 Analysis.

5.3.1 Distillation apparatus—Glass distillation apparatus assembled as shown in Figure 13A-2 (Method 13A).

5.3.2 Hot plate—Capable of heating to 500°C.

5.3.3 Electric muffle furnace—Capable of heating to 600°C.

5.3.4 Crucibles—Nickel, 75 to 100 ml capacity.

5.3.5 Beaker—1500 ml.

5.3.6 Volumetric flask—50 ml.

5.3.7 Erlenmeyer flask or plastic bottle—500 ml.

5.3.8 Constant temperature bath—Capable of maintaining a constant temperature of ±1.0°C in the range of room temperature.

5.3.9 Trip balance—300 g capacity to measure to ±0.5 g.

5.3.10 Fluoride ion activity sensing electrode.

5.3.11 Reference electrode—Single junction; sleeve type. (A combination-type electrode having the references electrode and the fluoride-ion sensing electrode built into one unit may also be used).

5.3.12 Electrometer—A pH meter with millivolt scale capable of ±0.1 mv resolution, or a specific ion meter made specifically for specific ion use.

5.3.13 Magnetic stirrer and TFE fluorocarbon coated stripping bars.

6. *Reagents.*

6.1 Sampling.

6.1.1 Filters—Whatman No. 1 filters, or equivalent, sized to fit filter holder.

6.1.2 Silica get—Indicating type, 6–16 mesh. If previously used, dry at 175°C (350°F) for 2 hours. New silica gel may be used as received.

6.1.3 Water—Distilled.

6.1.4 Crushed ice.

6.1.5 Stopcock grease—Acetone insoluble, heat stable silicone grease. This is not necessary if screw-on connectors with teflon sleeves, or similar, are used.

6.2 Sample recovery.

6.2.1 Water—Distilled from same container as 6.1.3.

6.3 Analysis.

6.3.1 Calcium oxide (CaO)—Certified grade containing 0.005 percent fluoride or less.

6.3.2 Phenolphthalein Indicator—0.1 percent in 1:1 ethanol water mixture.

6.3.3 Sodium hydroxide (NaOH)—Pellets, ACS reagent grade or equivalent.

6.3.4 Sulfuric acid (H_2SO_4)—Concentrated, ACS reagent grade or equivalent.

6.3.' Filters—Whatman No. 541, or equivalent.

6.3.6 Water—Distilled, from same container as 6.1.3.

6.3.7 Total Ionic Strength Adjustment Buffer (TISAB)—Place approximately 500 ml of distilled water in a 1-liter beaker. Add 57 ml glacial acetic acid, 58 g sodium chloride, and 4 g CDTA (Cyclohexylene dinitrilo tetraacetic acid). Stir to dissolve. Place the beaker in a water bath to cool it. Slowly add 5 M NaOH to the solution, measuring the pH continuously with a calibrated pH/reference electrode pair, until the pH is 5.3. Cool to room temperature. Pour into a 1-liter flask and dilute to volume with distilled water. Commercially prepared TISAB buffer may be substituted for the above.

6.3.8 Fluoride Standard Solution—0.1 M fluoride reference solution. Add 4.20 grams of reagent grade sodium fluoride (NaF) to a 1-liter volumetric flask and add enough distilled water to dissolve. Dilute to volume with distilled water.

7. *Procedure.*

NOTE: The fusion and distillation steps of this procedure will not be required, if it can be shown to the satisfaction of the Administrator that the samples contain only water-soluble fluorides.

7.1 Sampling. The sampling shall be conducted by competent personnel experienced with this test procedure.

7.1.1 Pretest preparation. All train components shall be maintained and calibrated according to the procedure described in APTD-0576, unless otherwise specified herein.

Weigh approximately 200–300 g of silica gel in air tight containers to the nearest 0.5 g. Record the total weight, both silica gel and container, on the container. More silica gel may be used but care should be taken during sampling that it is not entrained and carried out from the impinger. As an alternative, the silica gel may be weighed directly in the impinger or its sampling holder just prior to the train assembly.

7.1.2 Preliminary determinations. Select the sampling site and the minimum number of sampling points according to Method 1 or as specified by the Administrator. Determine the stack pressure, temperature, and the range of velocity heads using Method 2 and moisture content using Approximation Method 4 or its alternatives for the purpose of making isokinetic sampling rate calculations. Estimates may be used. However, final results will be based on actual measurements made during the test.

Select a nozzle size based on the range of velocity heads such that it is not necessary to change the nozzle size in order to maintain isokinetic sampling rates. During the run, do not change the nozzle size. Ensure that the differential pressure gauge is capable of measuring the minimum velocity head value to within 10 percent, or as specified by the Administrator.

Select a suitable probe liner and probe length such that all traverse points can be sampled. Consider sampling from opposite sides for large stacks to reduce the length of probes.

Select a total sampling time greater than or equal to the minimum total sampling time specified in the test procedures for the specific industry such that the sampling time per point is not less than 2 min. or select some greater time interval as specified by the Administrator, and such that the sample volume that will be taken will exceed the required minimum total gas sample volume specified in the test procedures for the specific industry. The latter is based on an approximate average sampling rate. Note also that the minimum total sample volume is corrected to standard conditions.

It is recommended that a half-integral or integral number of minutes be sampled at each point in order to avoid timekeeping errors.

In some circumstances, e.g. batch cycles, it may be necessary to sample for shorter times at the traverse points and to obtain smaller gas sample volumes. In these cases, the Administrator's approval must first be obtained.

7.13 Preparation of collection train. During preparation and assembly of the sampling train, keep all openings where contamination can occur covered until just prior to assembly or until sampling is about to begin.

Place 100 ml of water in each of the first two impingers, leave the third impinger empty, and place approximately 200–300 g or more, if necessary, of preweighed silica gel in the fourth impinger. Record the weight of the silica gel and container on the data sheet. Place the empty container in a clean place for later use in the sample recovery.

Place a filter in the filter holder. Be sure that the filter is properly centered and the gasket properly placed so as to not allow the sample gas stream to circumvent the filter. Check filter for tears after assembly is completed.

When glass liners are used, install selected nozzle using a Viton A O-ring; the Viton A O-ring is installed as a seal where the nozzle is connected to a glass liner. See APTD-0576 for details. When metal liners are used, install the nozzle as above or by a leak free direct mechanical connection. Mark the probe with heat resistant tape or by some other method to denote the proper distance into the stack or duct for each sampling point.

Unless otherwise specified by the Administrator, attach a temperature probe to the metal sheath of the sampling probe so that the sensor extends beyond the probe tip and does not touch any metal. Its position should be about 1.9 to 2.54 cm (0.75 to 1 in.) from the pitot tube and probe nozzle to avoid interference with the gas flow.

Assemble the train as shown in Figure 13A-1 (Method 13A) with the filter between the third and fourth impingers. Alternatively, the filter may be placed between the probe and first impinger. A filter heating system may be used to prevent moisture condensation, but the temperature around the filter holder shall not exceed 1200±14°C (248±25°F). [(Note: Whatman No. 1 filter decomposes at 150°C (300°F)).] Record filter location on the data sheet.

Place crushed ice around the impingers.

7.1.4 Leak check procedure—After the sampling train has been assembled, turn on and set (if applicable) the probe and filter heating system(s) to reach a temperature sufficient to avoid condensation in the probe. Allow time for the temperature to stabilize. Leak check the train at the sampling site by plugging the nozzle and pulling a 380 mm Hg (15 in. Hg) vacuum. A leakage rate in excess of 4% of the average sampling rate of 0.0057 m^3/min. (0.02 cfm), whichever is less, is unacceptable.

The following leak check instruction for the sampling train described in APTD-0576 and APTD-0581 may be helpful. Start the pump with by-pass valve fully open and coarse adjust valve completely closed. Partially open the coarse adjust valve and slowly close the by-pass valve until 380 mm Hg (15 in. Hg) vacuum is reached. *Do Not* reverse direction of by-pass valve. This will cause water to back up into the filter holder. If 380 mm Hg (15 in. Hg) is exceeded, either leak check at this higher vacuum or end the leak check as described below and start over.

When the leak check is completed, first slowly remove the plug from the inlet to the probe or filter holder and immediately turn off the vacuum pump. This prevents the water in the impingers from being forced backward into the filter holder (if placed before the impingers) and silica gel from being entrained backward into the third impinger.

Leak checks shall be conducted as described whenever the train is disengaged, e.g. for silica gel or filter changes during the test, prior to each test run, and at the completion of each test run. If leaks are found to be in excess of the acceptable rate, the test will be considered invalid. To reduce lost time due to leakage occurrences, it is recommended that leak checks be conducted between port changes.

7.1.5 Particulate train operation—During the sampling run, an isokinetic sampling rate within 10%, or as specified by the Administrator, of true isokinetic shall be maintained.

For each run, record the data required on the example data sheet shown in Figure 13A-3 (Method 13A). Be sure to record the initial dry gas meter reading. Record the dry gas meter readings at the beginning and end of each sampling time increment, when changes in flow rates are made, and when sampling is halted. Take other data point readings at least once at each sample point during each time increment and additional readings when significant changes (20% variation in velocity head readings) necessitate additional adjustments in flow rate. Be sure to level and zero the manometer.

Clean the portholes prior to the test run to minimize chance of sampling deposited material. To begin sampling, remove the nozzle cap, verify (if applicable) that the probe heater is working and filter heater is up to temperature, and that the pitot tube and probe are properly positioned. Position the nozzle at the first traverse point with the tip pointing directly into the gas stream. Immediately start the pump and adjust the flow to isokinetic conditions. Nomographs are available for sampling trains using type S pitot tubes with 0.85 ± 0.02 (coefficients (C_p), and when sampling in air or a stack gas with equivalent density (molecular weight, M_d, equal to 29 ± 4), which aid in the rapid adjustment of the isokinetic sampling rate without excessive computations. APTD-0576 details the procedure for using these nomographs. If C_p and M_d are outside the above stated ranges, do not use the nomograph unless appropriate steps are taken to compensate for the deviations.

When the stack is under significant negative pressure (height of impinger stem), take care to close the coarse adjust valve before inserting the probe into the stack to avoid water backing into the filter holder. If necessary, the pump may be turned on with the coarse adjust valve closed.

When the probe is in position, block off the openings around the probe and porthole to prevent unrepresentative dilution of the gas stream.

Traverse the stack cross section, as required by Method 1 or as specified by the Administrator, being careful not to bump the probe nozzle into the stack walls when sampling near the walls or when removing or inserting the probe through the portholes to minimize chance of extracting deposited material.

During the test run, make periodic adjustments to keep the probe and (if applicable) filter temperatures at their proper values. Add more ice and, if necessary, salt to the ice bath, to maintain a temperature of less than 20°C (68°F) at the impinger/silica gel outlet, to avoid excessive moisture losses. Also, periodically check the level and zero of the manometer.

If the pressure drop across the filter becomes high enough to make isokinetic sampling difficult to maintain, the filter may be replaced in the midst of a sample run. It is recommended that another complete filter assembly be used rather than attempting to change the filter itself. After the new filter or filter assembly is installed, conduct a leak check. The final emission results shall be based on the summation of all filter catches.

A single train shall be used for the entire sample run, except for filter and silica gel changes. However, if approved by the Administrator, two or more trains may be used for a single test run when there are two or more ducts or sampling ports. The final emission results shall be based on the total of all sampling train catches.

At the end of the sample run, turn off the pump, remove the probe and nozzle from the stack, and record the final dry gas meter reading. Perform a leak check.[1] Calculate percent isokinetic (see calculation section) to determine whether another test run should be made. If there is difficulty in maintaining isokinetic rates due to source conditions, consult with the Administrator for possible variance on the isokinetic rates.

7.2 Sample recovery. Proper cleanup procedure begins as soon as the probe is removed from the stack at the end of the sampling period.

When the probe can be safely handled, wipe off all external particulate matter near the tip of the probe nozzle and place a cap over it to keep from losing part of the sample. Do not cap off the probe tip tightly while the sampling train is cooling down, as this would create a vacuum in the filter holder, thus drawing water from the impingers into the filter.

Before moving the sample train to the cleanup site, remove the probe from the sample train, wipe off the silicone grease, and cap the open outlet of the probe. Be careful not to lose any condensate, if present. Wipe off the silicone grease from the filter inlet where the probe was fastened and cap it. Remove the umbilical cord from the last impinger and cap the impinger. After wiping off the silicone grease, cap off the filter holder outlet and impinger inlet. Ground glass stoppers, plastic caps, or serum caps may be used to close these openings.

Transfer the probe and filter-impinger assembly to the cleanup area. This area should be clean and protected from the wind so that the chances of contaminating or losing the sample will be minimized.

Inspect the train prior to and during disassembly and note any abnormal conditions. Using a graduated cylinder, measure and record the volume of the water in the first three impingers, to the nearest ml; any condensate in the probe should be included in this determination. Treat the samples as follows:

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7.2.1 Container No. 1. Transfer the impinger water from the graduated cylinder to this container. Add the filter to this container. Wash all sample exposed surfaces, including the probe tip, probe, first three impingers, impinger connectors, filter holder, and graduated cylinder thoroughly with distilled water. Wash each component three separate times with water and clean the probe and nozzle with brushes. A maximum wash of 500 ml is used, and the washings are added to the sample container which must be made of polyethylene.

7.2.2 Container No. 2. Transfer the silica gel from the fourth impinger to this container and seal.

7.3 Analysis. Treat the contents of each sample container as described below.

7.3.1 Container No. 1.

7.3.1.1 Filter this container's contents, including the Whatman No 1 filter, through Whatman No. 541 filter paper, or equivalent into a 1500 ml beaker. NOTE: If filtrate volume exceeds 900 ml make filtrate basic with NaOH to phenolphthalein and evaporate to less than 900 ml.

7.3.1.2 Place the Whatman No. 541 filter containing the insoluble matter (including the Whatman No. 1 filter) in a nickel crucible, add a few ml of water and macerate the filter with a glass rod.

Add 100 mg CaO to the crucible and mix the contents thoroughly to form a slurry. Add a couple of drops of phenolphthalein indicator. The indicator will turn red in a basic medium. The slurry should remain basic during the evaporation of the water or fluoride ion will be lost. If the indicator turns colorless during the evaporation, an acidic condition is indicated. If this happens add CaO until the color turns red again.

Place the crucible in a hood under infrared lamps or on a hot plate at low heat. Evaporate the water completely.

After evaporation of the water, place the crucible on a hot plate under a hood and slowly increase the temperature until the paper chars. It may take several hours for complete charring of the filter to occur.

Place the crucible in a cold muffle furnace and gradually (to prevent smoking) increase the temperature to 600°C, and maintain until the contents are reduced to an ash. Remove the crucible from the furnace and allow it to cool.

7.3.1.3 Add approximately 4 g of crushed NaOH to the crucible and mix. Return the crucible to the muffle furnace, and fuse the sample for 10 minutes at 600°C.

Remove the sample from the furnace and cool to ambient temperature. Using several rinsings of warm distilled water transfer the contents of the crucible to the beaker containing the filtrate from container No. 1 (7.3.1). To assure complete sample removal, rinse finally with two 20 ml portions of 25 percent (v/v) sulfuric acid and carefully add to the beaker. Mix well and transfer to a one-liter volumetric flask. Dilute to volume with distilled water and mix thoroughly. Allow any undissolved solids to settle.

7.3.2 Container No. 2. Weigh the spent silica gel and report to the nearest 0.5 g.

7.3.3 Adjustment of acid/water ratio in distillation flask—(Utilize a protective shield when carrying out this procedure). Place 400 ml of distilled water in the distilling flask and add 200 ml of concentrated H_2SO_4. Caution: Observe standard precautions when mixing the H_2SO_4 by slowly adding the acid to the flask with constant swirling. Add some soft glass beads and several small pieces of broken glass tubing and assemble the apparatus as shown in Figure 13A-2. Heat the flask until it reaches a temperature of 175°C to adjust the acid/water ratio for subsequent distillations. Discard the distillate.

7.3.4 Distillation—Cool the contents of the distillation flask to below 80°C. Pipette an aliquot of sample containing less than 0.6 mg F directly into the distilling flask and add distilled water to make a total volume of 220 ml added to the distilling flask. [For an estimate of what size aliquot does not exceed 0.6 mg F, select an aliquot of the solution and treat as described in Section 7.3.6. This will give an approximation of the fluoride content, but only an approximation since interfering ions have not been removed by the distillation step.]

Place a 250 ml volumetric flask at the condenser exist. Now begin distillation and gradually increase the heat and collect all the distillate up to 175°C. Caution: Heating the solution above 175°C will cause sulfuric acid to distill over.

The acid in the distilling flask can be used until there is carryover of interferences or poor fluoride recovery. An occasional check of fluoride recovery with standard solutions is advised. The acid should be changed whenever there is less than 90 percent recovery or blank values are higher than 0.1 ug/ml.

7.3.5 Determination of concentration—Bring the distillate in the 250 ml volumetric flask to the mark with distilled water and mix thoroughly. Pipette a 25 ml aliquot from the distillate. Add an equal volume of TISAB and mix. The sample should be at the same temperature as the calibration standards when measurements are made. If ambient lab temperature fluctuates more than ±2°C from the temperature at which the calibration standards were measured, condition samples and standards in a constant temperature bath measurement. Stir the sample with a magnetic stirrer during measurement to minimize electrode response time. If the stirrer generates enough heat to change solution temperature, place a piece of insulating material such as cork between the stirrer and the beaker. Dilute samples (below 10^{-4} M fluoride ion content) should be held in polyethylene or polypropylene beakers during measurement.

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[1] With acceptability of the test run to be based on the same criterion as in 7.1.4.

Insert the fluoride and reference electrodes into the solution. When a steady millivolt reading is obtained, record it. This may take several minutes. Determine concentration from the calibration curve. Between electrode measurements, soak the fluoride sensing electrode in distilled water for 30 seconds and then remove and blot dry.

8. *Calibration.*

Maintain a laboratory log of all calibrations.

8.1 Sampling Train.

8.1.1 Probe nozzle—Using a micrometer, measure the inside diameter of the nozzle to the nearest 0.025 mm (0.001 in.). Make 3 separate measurements using different diameters each time and obtain the average of the measurements. The difference between the high and low numbers shall not exceed 0.1 mm (0.004 in.).

When nozzles become nicked, dented, or corroded, they shall be reshaped, sharpened, and recalibrated before use.

Each nozzle shall be permanently and uniquely identified.

8.1.2 Pitot tube—The pitot tube shall be calibrated according to the procedure outlined in Method 2.

8.1.3 Dry gas meter and orifice meter. Both meters shall be calibrated according to the procedure outlined in APTD-0576. When diaphragm pumps with by-pass valves are used, check for proper metering system design by calibrating the dry gas meter at an additional flow rate of 0.0057 m^3/min. (0.2 cfm) with the by-pass valve fully opened and then with it fully closed. If there is more than ±2 percent difference in flow rates when compared to the fully closed position of the by-pass valve, the system is not designed properly and must be corrected.

8.1.4 Probe heater calibration—The probe heating system shall be calibrated according to the procedure contained in APTD-0576. Probes constructed according to APTD-0581 need not be calibrated if the calibration curves in APTD-0576 are used.

8.1.5 Temperature gauges—Calibrate dial and liquid filled bulb thermometers against mercury-in-glass thermometers. Thermocouples need not be calibrated. For other devices, check with the Administrator.

8.2 Analytical Apparatus.

8.2.1 Fluoride Electrode—Prepare fluoride standardizing solutions by serial dilution of the 0.1 M fluoride standard solution. Pipet 10 ml of 0.1 M NaF into a 100 ml volumetric flask and make up to the mark with distilled water for a 10^{-2} M standard solution. Use 10 ml of 10^{-2} M solution to make a 10^{-3} M solution in the same manner. Reapt 10^{-4} and 10^{-5} M solutions.

Pipet 50 ml of each standard into a separate beaker. Add 50 ml of TISAB to each beaker. Place the electrode in the most dilute standard solution. When a steady millivolt reading is obtained, plot the value on the linear axis of semi-log graph paper versus concentration on the log axis. Plot the nominal value for concentration of the standard on the log axis, e.g., when 50 ml of 10^{-2} M standard is diluted with 50 ml TISAB, the concentration is still designated "10^{-2} M".

Between measurements soak the fluoride sensing electrode in distilled water for 30 seconds, and then remove and blot dry. Analyze the standards going from dilute to concentrated standards. A straight-line calibration curve will be obtained, with nominal concentrations of 10f^{5}, 10f^{4}, 10^{-3}, 10^{-2}, 10^{-1} concentrations of 10^{-5}, 10^{-4}, 10^{-3}, 10^{-2}, 10^{-1} concentrations of 10^{-5}, 10^{-4}, 10^{-3}, 10f^{2}, 10f^{1} fluoride molarity on the log axis plotted versus electrode potential (in millivolts) on the linear scale.

Calibrate the fluoride electrode daily, and check it hourly. Prepare fresh fluoride standardizing solutions daily of 10^{-3} M or less. Store fluoride standardizing solutions in polyethylene or polypropylene containers. (Note: Certain specific ion meters have been designed specifically for fluoride electrode use and give a direct readout of fluoride ion concentration. These meters may be used in lieu of calibration curves for fluoride measurements over narrow concentration ranges. Calibrate the meter according to manufacturer's instructions.)

9. *Calculations.*

Carry out calculations, retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after final calculation.

9.1 Nomenclature.

A_n=Cross sectional area of nozzle, m^2 (ft^2).
A_t=Aliquot of total sample added to still, ml.
B_{ws}=Water vapor in the gas stream, proportion by volume.
C_s=Concentration of fluoride in stack gas, mg/m^3, corrected to standard conditions of 20° C, 760 mm Hg (68° F, 29.92 in. Hg) on dry basis.
F_t=Total weight of fluoride in sample, mg.
I=Percent of isokinetic sampling.
M=Concentration of fluoride from calibration curve, molarity.
m_n=Total amount of particulate matter collected, mg.
M_w=Molecular weight of water, 18 g/g-mole (18 lb/lb-mole).
m_a=Mass of residue of acetone after evaporation, mg.
P_{bar}=Barometric pressure at the sampling site, mm Hg (in. Hg).
P_s=Absolute stack gas pressure, mm Hg (in. Hg).
P_{std}=Standard absolute pressure, 760 mm Hg (29.92 in. Hg).
R=Ideal gas constant, 0.06236 mm Hg-m^3/°K-g-mole (21.83 in. Hg-ft^3/°R-lb-mole).
T_m=Absolute average dry gas meter temperature (see fig. 13A-3), °K (°R).
T_s=Absolute average stack gas temperature (see fig. 13A-3), °K (°R).
T_{std}=Standard absolute temperature, 293° K (528° R).
V_a=Volume of acetone blank, ml.
V_{aw}=Volume of acetone used in wash, ml.
V_d=Volume of distillate collected, ml.
V_{lc}=Total volume of liquid collected in impingers and silica gel, ml. Volume of water in silica gel equals silica gel weight increase in grams times 1 ml/gram. Volume of liquid collected in impinger equals final volume minus initial volume.
V_m=Volume of gas sample as measured by dry gas meter, dcm (dcf).
$V_{m(std)}$=Volume of gas sample measured by the dry gas meter corrected to standard conditions, dscm (dscf).
$V_{w(std)}$=Volume of water vapor in the gas sample corrected to standard conditions, scm (scf).
V_t=Total volume of sample, ml.
v_s=Stack gas velocity, calculated by Method 2, Equation 2-7 using data obtained from Method 5, m/sec (ft/sec).
W_a=Weight of residue in acetone wash, mg.
ΔH=Average pressure differential across the orifice (see fig. 13A-3), meter, mm H_2O (in. H_2O).
ρ_a=Density of acetone, mg/ml (see label on bottle).
ρ_w=Density of water, 1 g/ml (0.00220 lb/ml).
θ=Total sampling time, min.
13.6=Specific gravity of mercury.
60=Sec/min.
100=Conversion to percent.

9.2 Average dry gas meter temperature and average orifice pressure drop. See data sheet (Figure 13A-3 of Method 13A).

9.3 Dry gas volume. Use Section 9.3 of Method 13A.

9.4 Volume of Water Vapor. Use Section 9.4 of Method 13A.

9.5 Moisture Content. Use Section 9.5 of Method 13A.

9.6 Concentration

9.6.1 Calculate the amount of fluoride in the sample according to equation 13B-1.

$$F_t = K \frac{V_t}{A_t} (V_d) \ (M)$$

where:

K=10 mg/ml.

9.6.2 Concentration of fluoride in stack gas. Use Section 9.6.2 of Method 13A.

9.7 Isokinetic variation. Use Section 9.7 of Method 13A.

9.8 Acceptable results. Use Section 9.8 of Method 13A.

10. *References.*

Bellack, Ervin, "Simplified Fluoride Distillation Method," *Journal of the American Water Works Association* #50: 530-6 (1958).

MacLeod, Kathryn E., and Howard L. Crist, "Comparison of the SPADNS—Zirconium Lake and Specific Ion Electrode Methods of Fluoride Determination in Stack Emission Samples," *Analytical Chemistry* 45: 1272-1273 (1973).

Martin, Robert M. "Construction Details of Isokinetic Source Sampling Equipment," Environmental Protection Agency, Air Pollution Control Office Publication No. APTD-0581.

1973 Annual Book of ASTM Standards, Part 23, Designation: D 1179-72.

Pom, Jerome J., "Maintenance, Calibration, and Operation of Isokinetic Source Sampling Equipment," Environmental Protection Agency, Air Pollution Control Office Publication No. APTD-0576.

Standard Methods for the Examination of Water and Waste Water, published jointly by American Public Health Association, American Water Works Association and Water Pollution Control Federation, 13th Edition (1971).

(Sections 111 and 114 of the Clean Air Act, as amended by section 4(a) of Pub. L. 91-604, 84 Stat. 1678 (42 U.S.C. 1857 c-6, c-9))

[FR Doc.75-20478 Filed 8-5-75;8:45 am]

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[FRL 428-4]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Delegations of Authority to State of California on Behalf of Bay Area, Monterey Bay Unified, Humboldt County and Del Norte County Air Pollution Control Districts

Pursuant to the delegations of authority for the standards of performance for new stationary sources (NSPS) to the State of California on behalf of the Bay Area and Monterey Bay Unified Air Pollution Control Districts (dated May 23, 1975), and on behalf of the Humboldt County and Del Norte County Air Pollution Control Districts (dated July 10, 1975), EPA is today amending 40 CFR 60.4, Address, to reflect these delegations. Notices announcing these delegations are published today in the Notices Section of this issue. The amended § 60.4 is set forth below. It adds the addresses of the Bay Area, Monterey Bay Unified, Humboldt County and Del Norte County Air Pollution Control Districts, to which must be addressed all reports, requests, applications, submittals, and communications pursuant to this part by sources subject to the NSPS located within these Air Pollution Control Districts.

The Administrator finds good cause for foregoing prior public notice and for making this rulemaking effective immediately in that it is an administrative change and not one of substantive content. No additional substantive burdens are imposed on the parties affected. The delegations which are reflected by this administrative amendment were effective on May 23, 1975 (Bay Area and Monterey Bay Districts) and on July 10, 1975 (Humboldt County and Del Norte County Districts) and it serves no purpose to delay the technical change of this addition of the Air Pollution Control District addresses to the Code of Federal Regulations.

This rulemaking is effective immediately, and is issued under the authority of section 111 of the Clean Air Act, as amended. 42 U.S.C. 1857c–6.

Dated: September 6, 1975.

Stanley W. Legro,
Assistant Administrator for Enforcement.

Part 60 of Chapter I, Title 40 of the Code of Federal Regulations is amended as follows:

1. In § 60.4, paragraph (b) is amended by revising subparagraph (F), to read as follows:

§ 60.4 Address.

* * * * *

(b) * * *

(A)–(E) * * *

(F) California

Bay Area Air Pollution Control District, 939 Ellis St., San Francisco, CA 94109.

Del Norte County Air Pollution Control District, 5600 S. Broadway, Eureka, CA 95501.

Humboldt County Air Pollution Control District, 5600 S. Broadway, Eureka, CA 95501.

Monterey Bay Unified Air Pollution Control District, 420 Church St. (P.O. Box 487), Salinas, CA 93901.

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[FR Doc.75-24203 Filed 9-10-75;8:45 am]

FEDERAL REGISTER, VOL. 40, NO. 177—THURSDAY, SEPTEMBER 11, 1975

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Title 40—Protection of Environment

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

SUBCHAPTER C—AIR PROGRAMS

[FRL 407-8]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Electric Arc Furnaces in the Steel Industry

On October 21, 1974 (39 FR 37466), under section 111 of the Clean Air Act, as amended, the Environmental Protection Agency (EPA) proposed standards of performance for new and modified electric arc furnaces in the steel industry. Interested persons participated in the rulemaking by submitting written comments to EPA. A total of 19 comment letters was received, seven of which came from the industry, eight from State and local air pollution control agencies, and four from Federal agencies. The Freedom of Information Center, Room 202 West Tower, 401 M Street, S.W., Washington, D.C., has copies of the comment letters received and a summary of the issues and Agency responses available for public inspection. In addition, copies of the issue summary and Agency responses may be obtained upon written request from the EPA Public Information Center (PM-215), 401 M Street, S.W., Washington, D.C. 20460 (specify—Public Comment Summary: Electric Arc Furnaces in the Steel Industry). The comments have been carefully considered, and where determined by the Administrator to be appropriate, changes have been made to the proposed regulation and are incorporated in the regulation promulgated herein.

The bases for the proposed standards are presented in "Background Information for Standards of Performance: Electric Arc Furnaces in the Steel Industry," (EPA-450/2-74-017a, b). Copies of this document are available on request from the Emission Standards and Engineering Division, Environmental Protection Agency, Research Triangle Park, N.C. 27711, Attention: Mr. Don R. Goodwin.

SUMMARY OF REGULATION

The promulgated standards of performance for new and modified electric arc furnaces in the steel industry limit particulate matter emissions from the control device, from the shop, and from the dust-handling equipment. Emissions from the control device are limited to less than 12 mg/dscm (0.0052 gr/dscf) and 3 percent opacity. Furnace emissions escaping capture by the collection system and exiting from the shop are limited to zero percent opacity, but emissions greater than this level are allowed during charging periods and tapping periods. Emissions from the dust-handling equipment are limited to less than 10 percent opacity. The regulation requires monitoring of flow rates through each separately ducted emission capture hood and monitoring of the pressure inside the electric arc furnace for direct shell evacuation systems. Additionally, continuous monitoring of opacity of emissions from the control device is required.

SIGNIFICANT COMMENTS AND CHANGES MADE TO THE PROPOSED REGULATION

All of the comment letters received by EPA contained multiple comments. The most significant comments and the differences between the proposed and promulgated regulations are discussed below. In addition to the discussed changes, a number of paragraphs and sections of the proposed regulation were reorganized in the regulation promulgated herein.

(1) *Applicability*. One commentator questioned whether electric arc furnaces that use continuous feeding of prereduced ore pellets as the primary source of iron can comply with the proposed standards of performance since the standards were based on data from conventionally charged furnaces. Electric arc furnaces that use prereduced ore pellets were not investigated by EPA because this process was still being researched by the steel industry during development of the standard and was several years from extensive use on commercial sized furnaces. Emissions from this type of furnace are generated at different rates and in different amounts over the steel production cycle than emissions from conventionally charged furnaces. The proposed standards were structured for the emission cycle of a conventionally charged electric arc furnace. The standards, consequently, are not suitable for application to electric arc furnaces that use prereduced ore pellets as the primary source of iron. Even with use of best available control technology, emissions from these furnaces may not be controllable to the level of all of the standards promulgated herein; however, over the entire cycle the emissions may be less than those from a well-controlled conventional electric arc furnace. Therefore, EPA believes that standards of performance for electric arc furnaces using prereduced ore pellets require a different structure than do standards for conventionally charged furnaces. An investigation into the emission reduction achievable and best available control technology for these furnaces will be conducted in the future and standards of performance will be established. Consequently, electric arc furnaces that use continuous feeding of prereduced ore pellets as the primary source of iron are not subject to the requirements of this subpart.

(2) *Concentration standard for emissions from the control device*. Four commentators recommended revising the concentration standard for the control device effluent to 18 mg/dscm (0.008 gr/dscf) from the proposed level of 12 mg/dscm (0.0052 gr/dscf). The argument for the higher standard was that the proposed standard had not been demonstrated on either carbon steel shops or on combination direct shell evacuation-canopy hood control systems. Emission measurement data presented in "Background Information for Standards of Performance: Electric Arc Furnaces in the Steel Industry" show that carbon steel shops as well as alloy steel shops can reduce particulate matter emissions to less than 12 mg/dscm by application of well-designed fabric filter collectors. These data also show that combination direct shell evacuation-canopy hood systems can control emission levels to less than 12 mg/dscm. EPA believes that revising the standard to 18 mg/dscm would allow relaxation of the design requirements of the fabric filter collectors which are installed to meet the standard. Accordingly, the standard promulgated herein limits particulate matter emissions from the control device to less than 12 mg/dscm.

Two commentators requested that specific concentration and opacity standards be established for emissions from scrubber controlled direct shell evacuation systems. The argument for a separate concentration standard was that emissions from scrubber controlled direct shell evacuation systems can be reduced to only about 50 mg/dscm (0.022 gr/dscf) and, thus, even with the proposed proration provisions under § 60.274(b), it is not possible to use scrubbers and comply with the proposed concentration standard. The commentators also argued that a separate opacity standard was necessary for scrubber equipped systems because the effluent is more concentrated and, thus, reflects and scatters more visible light than the effluent from fabric filter collectors.

EPA would like to emphasize that use of venturi scrubbers to control the effluent from direct shell evacuation systems is not considered to be a "best system of emission reduction considering costs." The promulgated standards of performance for electric arc furnaces reflect the degree of emission reduction achievable for systems discharging emissions through fabric filter collectors. EPA believes, however, that the regulation does not preclude use of control systems that discharge direct shell evacuation system emissions through venturi scrubbers. Available information indicates that effluent from a direct shell evacuation system can be controlled to 0.01 gr/dscf or less using a high energy venturi scrubber (pressure drop greater than 60 in. w.g.). If the scrubber reduces particulate matter emissions to 0.01 gr/dscf, then the fabric filter collector is only required to reduce the emissions from the canopy hood to about 0.004 gr/dscf in order for the emission rates to be less than 0.0052 gr/dscf. Therefore, it is technically feasible for a facility to use a high energy scrubber and a fabric filter to control the combined furnace emissions to less than 0.0052 gr/dscf. A concentration standard of 0.022 gr/dscf for scrubbers would not require installation of control devices which have a collection efficiency comparable to that of best control technology (well-designed and well-operated fabric filter collector). In addition, electric arc furnace particulate matter emissions are invisible to the human eye at effluent concentrations less than 0.01 gr/dscf when emitted from average diameter stacks. For the reasons discussed above, neither a separate concentration standard nor a separate opacity standard will be established as suggested by the commentators.

(3) *Control device opacity standard.* Four commentators suggested that the proposed control device opacity standard either be revised from less than five percent opacity to less than ten percent opacity based on six-minute average values or that a time exemption be provided for visible emissions during the cleaning cycle of shaker-type fabric filter collectors.

EPA's experience indicates that a time exemption to allow for puffing during the cleaning cycle of the fabric filter collector is not necessary. For this application, a well-designed and well-maintained fabric filter collector should have no visible emissions during all phases of the operating cycle. The promulgated opacity standard, therefore, does not provide a time exemption for puffing of the collector during the cleaning cycle.

The suggested revision of the proposed opacity standard to ten percent (based on six-minute average values) was considered in light of recent changes in Method 9 of Appendix A to this part (39 FR 39872). The revisions to Method 9 require that compliance with opacity standards be determined by averaging sets of 24 consecutive observations taken at 15-second intervals (six-minute averages). All six-minute average values of the opacity data used as the basis for the proposed opacity standard are zero percent. EPA believes that the ten percent standard suggested by the commentators would allow much less effective operation and maintenance of the control device than is required by the concentration standard. On the basis of available data, a five percent opacity standard (based on six-minute average values) also is unnecessarily lenient.

The proposed opacity standard of zero percent was revised slightly upward to be consistent with previously established opacity standards which are less stringent than their associated concentration standards without being unduly lax. The promulgated opacity standard limits emissions from the control device to less than three percent opacity (based on averaging sets of 24 consecutive observations taken at 15-second intervals). Use of six-minute average values to determine compliance with applicable opacity standards makes opacity levels of any value possible, instead of the previous method's limitation of values at discrete intervals of five percent opacity.

(4) *Standards on emissions from the shop.* Twelve commentators questioned the value of the shop opacity standards, arguing that the proposed standards are unenforceable, too lenient, or too stringent.

Commentators arguing for less stringent or more stringent standards suggested various alternative opacity values for the charging or tapping period standards, different averaging periods, and a different limitation on emissions from the shop during the meltdown and refining period of the EAF operation. Because of these comments, the basis for these standards was thoroughly reevaluated, including a review of all available data and follow-up contacts with commentators who had offered suggestions. The follow-up contacts revealed that the suggested revisions were opinions only and were not based on actual data. The reevaluation of the data bases of the proposed standards reaffirmed that the standards represented levels of emission control achievable by application of best control technology considering costs. Hence, EPA concluded that the standards are reasonable (neither too stringent nor too lenient) and that revision of these standards is not warranted in the absence of specific information indicating such a need.

Four commentators believed that the proposed standards were impractical to enforce for the following reasons:

(1) Intermingling of emissions from non-regulated sources with emissions from the electric arc furnaces would make enforcement of the standards impossible.

(2) Overlap of operations at multi-furnace shops would make it difficult to identify the periods in which the charging and tapping standards are applicable.

(3) Additional manpower would be required in order to enforce these standards.

(4) The standards would require access to the shop, providing the source with notice of surveillance and the results would not be representative of routine emissions.

(5) The standards would be unenforceable at facilities with a mixture of existing and new electric arc furnaces in the same shop.

EPA considered all of the comments on the enforceability of the proposed standards and concluded that some changes were appropriate. The proposed regulation was reconsidered with the intent of developing more enforceable provisions requiring the same level of control. This effort resulted in several changes to the regulation, which are discussed below.

The promulgated regulation retains the proposed limitations on the opacity of emissions exiting from the shop except for the exemption of one minute/hour per EAF during the refining and meltdown periods. The purpose of this exemption was to provide some allowance for puffs due to "cave-ins" or addition of iron ore or burnt lime through the slag door. Only one suspected "cave-in" and no puffs due to additions occurred during 15 hours of observations at a well-controlled facility; therefore, it was concluded that these brief uncontrolled puffs do not occur frequently and whether or not a "cave-in" has occurred is best evaluated on a case-by-case basis. This approach was also necessitated by recent revisions to Method 9 (39 FR 39872) which require basing compliance on six-minute averages of the observations. Use of six-minute averages of opacity readings is not consistent with allowing a time exemption. Determination of whether brief puffs of emissions occurring during refining and meltdown periods are due to "cave-ins" will be made at the time of determination of compliance. If such emissions are considered to be due to a "cave-in" or other uncontrollable event, the evaluation may be repeated without any change in operating conditions.

The purpose of the proposed opacity standards limiting the opacity of emissions from the shop was to require good capture of the furnace emissions. The method for routinely enforcing these capture requirements has been revised in the regulation promulgated herein in that the owner or operator is now required to demonstrate compliance with the shop opacity standards just prior to conducting the performance test on the control device. This performance evaluation will establish the baseline operating flow rates for each of the canopy hoods or other fume capture hoods and the furnace pressures for the electric arc furnace using direct shell evacuation systems. Continuous monitoring of the flow rate through each separately ducted control system is required for each electric arc furnace subject to this regulation. Owners or operators of electric arc furnaces that use a direct shell evacuation system to collect the refining and meltdown period emissions are required to continuously monitor the pressure inside the furnace free space. The flow rate and pressure data will provide a continuous record of the operation of the control systems. Facilities that use a building evacuation system for capture and control of emissions are not subject to the flow rate and pressure monitoring requirements if the building roof is never opened.

The shop opacity standards promulgated herein are applicable only during demonstrations of compliance of the affected facility. At all other times the operating conditions must be maintained at the baseline values or better. Use of operating conditions that will result in poorer capture of emissions constitutes unacceptable operation and maintenance of the affected facility. These provisions of the promulgated regulation will allow evaluation of the performance of the collection system without interference from other emission sources because the non-regulated sources can be shut down for the duration of the evaluation. The monitoring of operations requirements will simplify enforcement of the regulation because neither the enforcing agency nor the owner or operator must show that any apparent violation was or was not due to operation of non-regulated sources.

The promulgated regulation's monitoring of operation requirements will add negligible additional costs to the total cost of complying with the promulgated standards of performance. Flow rate monitoring devices of sufficient accuracy to meet the requirements of § 60.274(b) can be installed for $600–$4000 depending on the flow profile of the area being monitored and the complexity of the monitoring device. Devices that monitor the pressure inside the free space of an electric arc furnace equipped with a direct shell evacuation system are installed by most owners or operators in order to obtain better control of the furnace operation. Consequently, for most owners or operators, the pressure monitoring requirements will only result in the additional costs for installation and operation of a strip chart recorder. A suitable strip chart recorder can be installed for less than $600.

There are no data reduction requirements in the flow rate monitoring provisions. The pressure monitoring provisions for the direct shell evacuation control systems require recording of the pressures as 15-minute integrated averages. The pressure inside the electric arc furnace above the slag and metal fluctuates rapidly. Integration of the data over 15-minute periods is necessary to provide an indication of the operation of the system. Electronic and mechanical integrators are available at an initial cost of less than $600 to accomplish this task. Electronic circuits to produce a continuous integration of the data can be built directly into the monitoring device or can be provided as a separate modular component of the monitoring system. These devices can provide a continuous integrated average on a strip chart recorder.

(5) *Emission monitoring.* Three commentators suggested deletion of the proposed opacity monitoring requirements because long path lengths and multiple compartments in pressurized fabric filter collectors make monitoring infeasible. The proposed opacity monitoring requirements have not been deleted because opacity monitoring is feasible on the control systems of interest (closed or suction fabric filter collectors). This subpart also permits use of alternative control systems which are not amenable to testing and monitoring using existing procedures, providing the owner or operator can demonstrate compliance by alternative methods. If the owner or operator plans to install a pressurized fabric filter collector, he should submit for the Administrator's approval the emission testing procedures and the method of monitoring the emissions of the collector. The opacity of emissions from pressurized fabric filter collectors can be monitored using present instrumentation at a reasonable cost. Possible alternative methods for monitoring of emissions from pressurized fabric filter collectors include: (1) monitoring of several compartments by a conventional path length transmissometer and rotation of the transmissometer to other groups of collector compartments on a scheduled basis or (2) monitoring with several conventional path length transmissometers. In addition to monitoring schemes based on conventional path length transmissometers, a long path transmissometer could be used to monitor emissions from a pressurized fabric filter collector. Transmissometers capable of monitoring distances up to 150 meters are commercially available and have been demonstrated to accurately monitor opacity. Use of long path transmissometers on pressurized fabric filter collectors has yet to be demonstrated, but if properly installed there is no reason to believe that the transmissometer will not accurately and representatively monitor emissions. The best location for a long path transmissometer on a fabric filter collector will depend on the specific design features of both; therefore, the best location and monitoring procedure must be established on an individual basis and is subject to the Administrator's approval.

Two commentators argued that the proposed reporting requirements would result in excessive paperwork for the owner or operator. These commentators suggested basing the reporting requirements on hourly averages of the monitoring data. EPA believes that one-hour averaging periods would not produce values that would meaningfully relate to the operation of the fabric filter collector and would not be useful for comparison with Method 9 observations. In light of the revision of Method 9 to base compliance on six-minute averages, all six-minute periods in which the average opacity is three percent or greater shall be reported as periods of excess emissions. EPA does not believe that this requirement will result in an excessive burden for properly operated and maintained facilities.

(6) *Test methods and procedures.* Two commentators questioned the precision and accuracy of Method 5 of Appendix A to this part when applied to gas streams with particulate matter concentrations less than 12 mg/dscm. EPA has reviewed the sampling and analytical error associated with Method 5 testing of low concentration gas streams. It was concluded that if the recommended minimum sample volume (160 dscf) is used, then the errors should be within the acceptable range for the method. Accordingly, the recommended minimum sample volumes and times of the proposed regulation are being promulgated unchanged.

Three commentators questioned what methodology was to be used in testing of open or pressurized fabric filter collectors. These commentators advocated that EPA develop a reference test method for testing of pressurized fabric filter collectors. From EPA's experience, development of a single test procedure for representative sampling of all pressurized fabric filter collectors is not feasible because of significant variations in the design of these control devices. Test procedures for demonstrating compliance with the standard, however, can be developed on a case-by-case basis. The promulgated regulation does require that the owner or operator design and construct the control device so that representative measurement of the particulate matter emissions is feasible.

Provisions in 40 CFR 60.8(b) allow the owner or operator upon approval by the Administrator to show compliance with the standard of performance by use of an "equivalent" test method or "alternative" test method. For pressurized fabric filter collectors, the owner or operator is responsible for development of an "alternative" or "equivalent" test procedure which must be approved prior to the determination of compliance.

Depending on the design of the pressurized fabric filter collector, the performance test may require use of an "alternative" method which would produce results adequate to demonstrate compliance. An "alternative" method does not necessarily require that the effluent be discharged through a stack. A possible alternative procedure for testing is representative sampling of emissions from a randomly selected, representative number of compartments of the collector. If the flow rate of effluent from the compartments or other conditions are not amenable to isokinetic sampling, then subisokinetic sampling (that is, sampling at lower velocities than the gas stream velocity, thus biasing the sample toward collection of a greater concentration than is actually present) should be used. If a suitable "equivalent" or "alternative" test procedure is not developed by the owner or operator, then total enclosure of the collector and testing by Method 5 of Appendix A to this part is required.

A new paragraph has been added to clarify that during emission testing of pressurized fabric filter collectors the dilution air vents must be blocked off for the period of testing or the amount of dilution must be determined and a correction applied in order to accurately determine the emission rate of the control device. The need for dilution air correction was discussed in "Background Information for Standards of Performance: Electric Arc Furnaces in the Steel Industry" but was not an explicit requirement in the proposed regulation.

(7) *Miscellaneous.* Some commentators on the proposed standards of performance for ferroalloy production facilities (39 FR 37470) questioned the rationale for the differences between the electric arc furnace regulation and the ferroalloy production facilities regulation with respect to methods of limiting fugitive emissions. The intent of both regulations is to require effective capture and control of emissions from the source. The standards of performance for electric arc furnaces regulate collection efficiency by placing limitations on the opacity of emissions from the shop. The performance of the control system is evaluated at the shop roof and/or other areas of emission to the atmosphere because it is not possible to evaluate the performance of the collection system inside the shop. In electric arc furnace shops, collection systems for capture of charging and tapping period emissions must be located at least 30 or 40 feet above the furnace to allow free movement of the crane which charges raw materials to the furnace. Fumes from charging, tapping, and other activities rise and accumulate in the upper areas of the building, thus obscuring visibility. Because of the poor visibility within the shop, the performance of the emission collection system can only be evaluated at the point where emissions are discharged to the atmosphere. Ferroalloy electric submerged arc fur-

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nace operations do not require this large free space between the furnace and the collection device (hood). Visibility around the electric submerged arc furnace is good. Consequently, the performance of the collection device on a ferroalloy furnace may be evaluated at the collection area rather than at the point of discharge to the atmosphere.

Effective date. In accordance with section 111 of the Act, these regulations prescribing standards of performance for electric arc furnaces in the steel industry are effective on September 23, 1975, and apply to electric arc furnaces and their associated dust-handling equipment the construction or modification of which was commenced after October 21, 1974.

Dated: September 1[illegible], 1975.

JOHN QUARLES,
Acting Administrator.

Part 60 of Chapter I, Title 40 of the Code of Federal Regulations is amended as follows:

1. The table of sections is amended by adding subpart AA as follows:

* * * * *

Subpart AA—Standards of Performance for Steel Plants: Electric Arc Furnaces

60.270 Applicability and designation of affected facility.
60.271 Definitions.
60.272 Standard for particulate matter.
60.273 Emission monitoring.
60.274 Monitoring of operations.
60.275 Test methods and procedures.

* * * * *

2. Part 60 is amended by adding subpart AA as follows:

* * * * *

Subpart AA—Standards of Performance for Steel Plants: Electric Arc Furnaces

§ 60.270 Applicability and designation of affected facility.

The provisions of this subpart are applicable to the following affected facilities in steel plants: electric arc furnaces and dust-handling equipment.

§ 60.271 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in subpart A of this part.

(a) "Electric arc furnace" (EAF) means any furnace that produces molten steel and heats the charge materials with electric arcs from carbon electrodes. Furnaces from which the molten steel is cast into the shape of finished products, such as in a foundry, are not affected facilities included within the scope of this definition. Furnaces which, as the primary source of iron, continuously feed prereduced ore pellets are not affected facilities within the scope of this definition.

(b) "Dust-handling equipment" means any equipment used to handle particulate matter collected by the control device and located at or near the control device for an EAF subject to this subpart.

(c) "Control device" means the air pollution control equipment used to remove particulate matter generated by an EAF(s) from the effluent gas stream.

(d) "Capture system" means the equipment (including ducts, hoods, fans, dampers, etc.) used to capture or transport particulate matter generated by an EAF to the air pollution control device.

(e) "Charge" means the addition of iron and steel scrap or other materials into the top of an electric arc furnace.

(f) "Charging period" means the time period commencing at the moment an EAF starts to open and ending either three minutes after the EAF roof is returned to its closed position or six minutes after commencement of opening of the roof, whichever is longer.

(g) "Tap" means the pouring of molten steel from an EAF.

(h) "Tapping period" means the time period commencing at the moment an EAF begins to tilt to pour and ending either three minutes after an EAF returns to an upright position or six minutes after commencing to tilt, whichever is longer.

(i) "Meltdown and refining" means that phase of the steel production cycle when charge material is melted and undesirable elements are removed from the metal.

(j) "Meltdown and refining period" means the time period commencing at the termination of the initial charging period and ending at the initiation of the tapping period, excluding any intermediate charging periods.

(k) "Shop opacity" means the arithmetic average of 24 or more opacity observations of emissions from the shop taken in accordance with Method 9 of Appendix A of this part for the applicable time periods.

(l) "Heat time" means the period commencing when scrap is charged to an empty EAF and terminating when the EAF tap is completed.

(m) "Shop" means the building which houses one or more EAF's.

(n) "Direct shell evacuation system" means any system that maintains a negative pressure within the EAF above the slag or metal and ducts these emissions to the control device.

§ 60.272 Standard for particulate matter.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from an electric arc furnace any gases which:

(1) Exit from a control device and contain particulate matter in excess of 12 mg/dscm (0.0052 gr/dscf).

(2) Exit from a control device and exhibit three percent opacity or greater.

(3) Exit from a shop and, due solely to operations of any EAF(s), exhibit greater than zero percent shop opacity except:

(i) Shop opacity greater than zero percent, but less than 20 percent, may occur during charging periods.

(ii) Shop opacity greater than zero percent, but less than 40 percent, may occur during tapping periods.

(iii) Opacity standards under paragraph (a)(3) of this section shall apply only during periods when flow rates and pressures are being established under § 60.274 (c) and (f).

(iv) Where the capture system is operated such that the roof of the shop is closed during the charge and the tap, and emissions to the atmosphere are prevented until the roof is opened after completion of the charge or tap, the shop opacity standards under paragraph (a)(3) of this section shall apply when the roof is opened and shall continue to apply for the length of time defined by the charging and/or tapping periods.

(b) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from dust-handling equipment any gases which [illegible] percent opacity or greater.

§ 60.273 Emission monitoring.

(a) A continuous monitoring system for the measurement of the opacity of emissions discharged into the atmosphere from the control device(s) shall be installed, calibrated, maintained, and operated by the owner or operator subject to the provisions of this subpart.

(b) For the purpose of reports under § 60.7(c), periods of excess emissions that shall be reported are defined as all six-minute periods during which the average opacity is three percent or greater.

§ 60.274 Monitoring of operations.

(a) The owner or operator subject to the provisions of this subpart shall maintain records daily of the following information:

(1) Time and duration of each charge;

(2) Time and duration of each tap;

(3) All flow rate data obtained under paragraph (b) of this section, or equivalent obtained under paragraph (d) of this section; and

(4) All pressure data obtained under paragraph (e) of this section.

(b) Except as provided under paragraph (d) of this section, the owner or operator subject to the provisions of this subpart shall install, calibrate and maintain a monitoring device that continuously records the volumetric flow rate through each separately ducted hood. The monitoring device(s) may be installed in any appropriate location in the exhaust duct such that reproducible flow rate monitoring will result. The flow rate monitoring device(s) shall have an accuracy of ±10 percent over its normal operating range and shall be calibrated according to the manufacturer's instructions. The Administrator may require the owner or operator to demonstrate the accuracy of the monitoring device(s) relative to Methods 1 and 2 of Appendix A of this part.

(c) When the owner or operator of an EAF is required to demonstrate compliance with the standard under § 60.272 (a)(3) and at any other time the Administrator may require (under section 114 of the Act, as amended), the v metric flow rate through each separately ducted hood shall be determined during all periods in which the hood is operated for the purpose of capturing emissions from the EAF using the monitoring device under paragraph (b) of this section. The owner or operator may petition the Administrator for reestablishment of these flow rates whenever the owner or operator can demonstrate to the Administrator's satisfaction that the EAF operating conditions upon which the flow rates were previously established are no longer applicable. The flow rates determined during the most recent demonstration of compliance shall be maintained (or may be exceeded) at the appropriate level for each applicable period. Operation at lower flow rates may be considered by the Administrator to be unacceptable operation and maintenance of the affected facility.

(d) The owner or operator may petition the Administrator to approve any alternative method that will provide a continuous record of operation of each emission capture system.

(e) Where emissions during any phase of the heat time are controlled by use of a direct shell evacuation system, the owner or operator shall install, calibrate, and maintain a monitoring device that continuously records the pressure in the free space inside the EAF. The pressure shall be recorded as 15-minute integrated averages. The monitoring device may be installed in any appropriate location in the EAF such that reproducible results will be obtained. The pressure monitoring device shall have an accuracy of ±5 mm of water gauge over its normal operating range and shall be calibrated according to the manufacturer's instructions.

(f) When the owner or operator of an EAF is required to demonstrate compliance with the standard under § 60.272 (a)(3) and at any other time the Administrator may require (under section 114 of the Act, as amended), the pressure in the free space inside the furnace shall be determined during the meltdown and refining period(s) using the monitoring device under paragraph (e) of this section. The owner or operator may petition the Administrator for reestablishment of the 15-minute integrated average pressure whenever the owner or operator can demonstrate to the Administrator's satisfaction that the EAF operating conditions upon which the pressures were previously established are no longer applicable. The pressure determined during the most recent demonstration of compliance shall be maintained at all times the EAF is operating in a meltdown and refining period. Operation at higher pressures may be considered by the Administrator to be unacceptable operation and maintenance of the affected facility.

(g) Where the capture system is designed and operated such that all emissions are captured and ducted to a control device, the owner or operator shall not be subject to the requirements of this section.

§ 60.275 Test methods and procedures.

(a) Reference methods in Appendix A of this part, except as provided under § 60.8(b), shall be used to determine compliance with the standards prescribed under § 60.272 as follows:

(1) Method 5 for concentration of particulate matter and associated moisture content;

(2) Method 1 for sample and velocity traverses;

(3) Method 2 for velocity and volumetric flow rate; and

(4) Method 3 for gas analysis.

(b) For Method 5, the sampling time for each run shall be at least four hours. When a single EAF is sampled, the sampling time for each run shall also include an integral number of heats. Shorter sampling times, when necessitated by process variables or other factors, may be approved by the Administrator. The minimum sample volume shall be 4.5 dscm (160 dscf).

(c) For the purpose of this subpart, the owner or operator shall conduct the demonstration of compliance with 60.272(a)(3) and furnish the Administrator a written report of the results of the test.

(d) During any performance test required under § 60.8 of this part, no gaseous diluents may be added to the effluent gas stream after the fabric in any pressurized fabric filter collector, unless the amount of dilution is separately determined and considered in the determination of emissions.

(e) When more than one control device serves the EAF(s) being tested, the concentration of particulate matter shall be determined using the following equation:

$$C_t = \frac{\sum_{n=1}^{N} (C_s Q_s)_n}{\sum_{n=1}^{N} (Q_s)_n}$$

where:

C_s = concentration of particulate matter in mg/dscm (gr/dscf) as determined by method 5.

N = total number of control devices tested.

Q_s = volumetric flow rate of the effluent gas stream in dscm/hr (dscf/hr) as determined by method 2.

$(C_s Q_s)_n$ or $(Q_s)_n$ = value of the applicable parameter for each control device tested.

(f) Any control device subject to the provisions of this subpart shall be designed and constructed to allow measurement of emissions using applicable test methods and procedures.

(g) Where emissions from any EAF(s) are combined with emissions from facilities not subject to the provisions of this subpart but controlled by a common capture system and control device, the owner or operator may use any of the following procedures during a performance test:

(1) Base compliance on control of the combined emissions.

(2) Utilize a method acceptable to the Administrator which compensates for the emissions from the facilities not subject to the provisions of this subpart.

(3) Any combination of the criteria of paragraphs (g)(1) and (g)(2) of this section.

(h) Where emissions from any EAF(s) are combined with emissions from facilities not subject to the provisions of this subpart, the owner or operator may use any of the following procedures for demonstrating compliance with § 60.272 (a)(3):

(1) Base compliance on control of the combined emissions.

(2) Shut down operation of facilities not subject to the provisions of this subpart.

(3) Any combination of the criteria of paragraphs (h)(1) and (h)(2) of this section.

* * * * *

(Secs. 111 and 114 of the Clean Air Act, as amended by sec. 4(a) of Pub. L. 91-604, 84 Stat. 1678 (42 U.S.C. 1857c-6, 1857c-9))

[FR Doc.75-25138 Filed 9-22-75;8:45 am]

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Title 40—Protection of Environment

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

SUBCHAPTER C–A: PROGRAMS

[FRL 438-3]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Delegation of Authority To State of California on Behalf of Kern County and Trinity County Air Pollution Control Districts

Pursuant to the delegation of authority for the standards of performance for new stationary sources (NSPS) to the State of California on behalf of the Kern County Air Pollution Control District and the Trinity County Air Pollution Control District, dated August 18, 1975, EPA is today amending 40 CFR 60.4, Address, to reflect this delegation. A Notice announcing this delegation is published today at 40 FR ????. The amended § 60.4 is set forth below. It adds the addresses of the Kern County and Trinity County Air Pollution Control Districts, to which must be adressed all reports, requests, applications, submittals, and communications pursuant to this part by sources subject to the NSPS located within these Air Pollution Control Districts.

The Administrator finds good cause for foregoing prior public notice and for making this rulemaking effective immediately in that it is an administrative change and not one of substantive content. No additional substantive burdens are imposed on the parties affected. The delegation which is reflected by this administrative amendment was effective on August 18, 1975, and it serves no purpose to delay the technical change of this addition of the Air Pollution Control District addresses to the Code of Federal Regulations.

This rulemaking is effective immediately, and is issued under the authority of Section 111 of the Clean Air Act, as amended. 42 U.S.C. 1857c–6.

Dated: September 25, 1975.

STANLEY W. LEGRO,
Assistant Administrator for Enforcement.

Part 60 of Chapter I, Title 40 of the Code of Federal Regulations is amended as follows:

1. In § 60.4 paragraph (b) is amended by revising paragraph F, to read as follows:

§ 60.4 Address.

* * * * *

(b) * * *

(A)—(E) * * *

F—California—

Bay Area Air Pollution Control District, 939 Ellis St., San Francisco, CA 94109.

Del Norte County Air Pollution Control District, Courthouse, Crescent City, CA 95531.

Humboldt County Air Pollution Control District, 5600 S. Broadway, Eureka, CA 95501.

Kern County Air Pollution Control District, 1700 Flower St. (P.O. Box 997), Bakersfield, CA 93302.

Monterey Bay Unified Air Pollution Control District, 420 Church St. (P.O. Box 487), Salinas, CA 93901.

Trinity County Air Pollution Control District, Box AJ, Weaverville, CA 96093.

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[FR Doc.75–26271 Filed 9–30–75;8:45 am]

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[FRL 425-7]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Emission Monitoring Requirements and Revisions to Performance Testing Methods

On September 11, 1974 (39 FR 32852), the Environmental Protection Agency (EPA) proposed revisions to 40 CFR Part 60, Standards of Performance for New Stationary Sources, to establish specific requirements pertaining to continuous emission monitoring system performance specifications, operating procedures, data [redacted] 23 These requirements would apply to new and modified facilities covered under Part 60, but would not apply to existing facilities.

Simultaneously (39 FR 32871), the Agency proposed revisions to 40 CFR Part 51, Requirements for the Preparation, Adoption, and Submittal of Implementation Plans, which would require States to revise their State Implementation Plans (SIP's) to include legal enforceable procedures requiring certain specified stationary sources to monitor emissions on a continuous basis. These requirements would apply to existing facilities, which are not covered under Part 60.

Interested parties participated in the rulemaking by sending comments to EPA. A total of 105 comment letters were received on the proposed revisions to Part 60 from monitoring equipment manufacturers, data processing equipment manufacturers, industrial users of monitoring equipment, air pollution control agencies including State, local, and EPA regional offices, other Federal agencies, and consultants. Copies of the comment letters received and a summary of the issues and EPA's responses are available for inspection and copying at the U.S. Environmental Protection Agency, Public Information Reference Unit, Room 2922 (EPA Library), 401 M Street, S.W., Washington, D.C. In addition, copies of the issue summary and EPA responses may be obtained upon written request from the EPA Public Information Center (PM-215), 401 M Street, S.W., Washington, D.C. 20460 (specify Public Comment Summary: Emission Monitoring Requirements). The comments have been carefully considered, additional information has been collected and assessed, and where determined by the Administrator to be appropriate, changes have been made to the proposed regulations. These changes are incorporated in the regulations promulgated herein.

BACKGROUND

At the time the regulations were proposed (September 11, 1974), EPA had promulgated 12 standards of performance for new stationary sources under section 111 of the Clean Air Act, as amended, four of which required the affected facilities to install and operate systems which continuously monitor the levels of pollutant emissions, where the technical feasibility exists using currently available continuous monitoring technology, and where the cost of the systems is reasonable. When the four standards that require monitoring systems were promulgated, EPA had limited knowledge about the operation of such systems because only a few systems had been installed; thus, the requirements were specified in general terms. EPA initiated a program to develop performance specifications and obtain information on the operation of continuous monitoring systems. The program was designed to assess the systems' accuracy, reliability, costs, and problems related to installation, operation, maintenance, and data handling. The proposed regulations (39 FR 32852) were based on the results of this program.

The purpose of regulations promulgated herein is to establish minimum performance specifications for continuous monitoring systems, minimum data reduction requirements, operating procedures, and reporting requirements for those affected facilities required to install continuous monitoring systems. The specifications and procedures are designed to assure that the data obtained from continuous monitoring systems will be accurate and reliable and provide the necessary information for determining whether an owner or operator is following proper operation and maintenance procedures.

SIGNIFICANT COMMENTS AND CHANGES MADE TO PROPOSED REGULATIONS

Many of the comment letters received by EPA contained multiple comments. The most significant comments and the differences between the proposed and final regulations are discussed below.

(1) Subpart A—General Provisions. The greatest number of comments received pertained to the methodology and expense of obtaining and reporting continuous monitoring system emission data. Both air pollution control agencies and affected users of monitoring equipment presented the view that the proposed regulations requiring that all emission data be reported were excessive, and that reports of only excess emissions and retention of all the data for two years on the affected facility's premises is sufficient. Twenty-five commentators suggested that the effectiveness of the operation and maintenance of an affected facility and its air pollution control system could be determined by reporting only excess emissions. Fifteen others recommended deleting the reporting requirements entirely.

EPA has reviewed these comments and has contacted vendors of monitoring and data acquisition equipment for additional information to more fully assess the impact of the proposed reporting requirements. Consideration was also given to the resources that would be required of EPA to enforce the proposed requirement, the costs that would be incurred by an affected source, and the effectiveness of the proposed requirement in comparison with a requirement to report only excess emissions. EPA concluded that reporting only excess emissions would assure proper operation and maintenance of the air pollution control equipment and would result in lower costs to the source and allow more effective use of EPA resources by eliminating the need for handling and storing large amounts of data. Therefore, the regulation promulgated herein requires owners or operators to report only excess emissions and to maintain a permanent record of all emission data for a period of two years.

In addition, the proposed specification of minimum data reduction procedures has been changed. Rather than requiring integrated averages as proposed, the regulations promulgated herein also specify a method by which a minimum number of data points may be used to compute average emission rates. For example, average opacity emissions over a six-minute period may be calculated from a minimum of 24 data points equally spaced over each six-minute period. Any number of equally spaced data points in excess of 24 or continuously integrated data may also be used to compute six-minute averages. This specification of minimum computation requirements combined with the requirement to report only excess emissions provides source owners and operators with maximum flexibility to select from a wide choice of optional data reduction procedures. Sources which monitor only opacity and which infrequently experience excess emissions may choose to utilize strip chart recorders, with or without continuous six-minute integrators; whereas sources monitoring two or more pollutants plus other parameters necessary to convert to units of the emission standard may choose to utilize existing computers or electronic data processes incorporated with the monitoring system. All data must be retained for two years, but only excess emissions need be reduced to units of the standard. However, in order to report excess emissions, adequate procedures must be utilized to insure that excess emissions are identified. Here again, certain sources with minimal excess emissions can determine excess emissions by review of strip charts, while sources with varying emission and excess air rates will most likely need to reduce all data to units of the standard to identify any excess emissions. The regulations promulgated herein allow the use of extractive, gaseous monitoring systems on a time sharing basis by installing sampling probes at several locations, provided the minimum number of data points (four per hour) are obtained.

Several commentators stated that the averaging periods for reduction of monitoring data, especially opacity, were too short and would result in an excessive amount of data that must be reduced and recorded. EPA evaluated these comments and concluded that to be useful to source owners and operators as well as enforcement agencies, the averaging time for the continuous monitoring data should be reasonably consistent with the averaging time for the reference methods used during performance tests. The data reduction requirements for opacity have been substantially reduced because the averaging period was changed from one minute, which was proposed, to six minutes to be consistent with revisions made to Method 9 (39 FR 39872).

Numerous comments were received on proposed § 60.13 which resulted in several changes. The proposed section has been reorganized and revised in several respects to accommodate the comments and provide clarity, to more specifically delineate the equipment subject to Performance Specifications in Appendix B, and to more specifically define requirements for equipment purchased prior to September 11, 1974. The provisions in § 60.13 are not intended to prevent the use of any equipment that can be demonstrated to be reliable and accurate; therefore, the performance of monitoring systems is specified in general terms with minimal references to specific equipment types. The provisions in § 60.13(i) are included to allow owners or operators and equipment vendors to apply to the Administrator for approval to use alternative equipment or procedures when equipment capable of producing accurate results may not be commercially available (e.g. condensed water vapor interferes with measurement of opacity), when unusual circumstances may justify less costly procedures, or when the owner or operator or equipment vendor may simply prefer to use other equipment or procedures that are consistent with his current practices.

Several paragraphs in § 60.13 have been changed on the basis of the comments received. In response to comments that the monitor operating frequency requirements did not consider periods when the monitor is inoperative or undergoing maintenance, calibration, and adjustment, the operating frequency requirements have been changed. Also the frequency of cycling requirement for opacity monitors has been changed to be consistent with the response time requirement in Performance Specification 1, which reflects the capability of commercially available equipment.

A second area that received comment concerns maintenance performed upon continuous monitoring systems. Six commentators noted that the proposed regulation requiring extensive retesting of continuous monitoring systems for all minor failures would discourage proper maintenance of the systems. Two other commentators noted the difficulty of determining a general list of critical components, the replacement of which would automatically require a retest of the system. Nevertheless, it is EPA's opinion that some control must be exercised to insure that a suitable monitoring system is not rendered unsuitable by substantial alteration or a lack of needed maintenance. Accordingly, the regulations promulgated herein require that owners or operators submit with the quarterly report information on any repairs or modifications made to the system during the reporting period. Based upon this information, the Administrator may review the status of the monitoring system with the owner or operator and, if determined to be necessary, require retesting of the continuous monitoring system(s).

Several commentators noted that the proposed reporting requirements are unnecessary for affected facilities not required to install continuous monitoring systems. Consequently, the regulations promulgated herein do not contain the requirements.

Numerous comments were received which indicated that some monitoring systems may not be compatible with the proposed test procedures and requirements. The comments were evaluated and, where appropriate, the proposed test procedures and requirements were changed. The procedures and requirements promulgated herein are applicable to the majority of acceptable systems; however, EPA recognizes that there may be some acceptable systems available now or in the future which could not meet the requirements. Because of this, the regulations promulgated herein include a provision which allows the Administrator to approve alternative testing procedures. Eleven commentators noted that adjustment of the monitoring instruments may not be necessary as a result of daily zero and span checks. Accordingly, the regulations promulgated herein require adjustments only when applicable 24-hour drift limits are exceeded. Four commentators stated that it is not necessary to introduce calibration gases near the probe tips. EPA has demonstrated in field evaluations that this requirement is necessary in order to assure accurate results; therefore, the requirement has been retained. The requirement enables detection of any dilution or absorption of pollutant gas by the plumbing and conditioning systems prior to the pollutant gas entering the gas analyzer.

Provisions have been added to these regulations to require that the gas mixtures used for the daily calibration check of extractive continuous monitoring systems be traceable to National Bureau of Standards (NBS) reference gases. Calibration gases used to conduct system evaluations under Appendix B must either be analyzed prior to use or shown to be traceable to NBS materials. This traceability requirement will assure the accuracy of the calibration gas mixtures and the comparability of data from systems at all locations. These traceability requirements will not be applied whenever the NBS materials are not available. A list of available NBS Standard Reference Materials may be obtained from the Office of Standard Reference Materials, Room B311, Chemistry Building, National Bureau of Standards, Washington, D.C. 20234.

Recertification of the continued accuracy of the calibration gas mixtures is also necessary and should be performed at intervals recommended by the calibration gas mixture manufacturer. The NBS materials and calibration gas mixtures traceable to these materials should not be used after expiration of their stated shelf-life. Manufacturers of calibration gas mixtures generally use NBS materials for traceability purposes, therefore, these amendments to the regulations will not impose additional requirements upon most manufacturers.

(2) Subpart D—Fossil-Fuel Fired Steam Generators. Eighteen commentators had questions or remarks concerning the proposed revisions dealing with fuel analysis. The evaluation of these comments and discussions with coal suppliers and electric utility companies led the Agency to conclude that the proposed provisions for fuel analysis are not adequate or consistent with the current fuel situation. An attempt was made to revise the proposed provisions; however, it became apparent that an in-depth study would be necessary before meaningful provisions could be developed. The Agency has decided to promulgate all of the regulations except those dealing with fuel analysis. The fuel analysis provisions of Subpart D have been reserved in the regulations promulgated herein. The Agency has initiated a study to obtain the necessary information on the variability of sulfur content in fuels, and the capability of fossil fuel fired steam generators to use fuel analysis and blending to prevent excess sulfur dioxide emissions. The results of this study will be used to determine whether fuel analysis should be allowed as a means of measuring excess emissions, and if allowed, what procedure should be required. It should be pointed out that this action does not affect facilities which use flue gas desulfurization as a means of complying with the sulfur dioxide standard; these facilities are still required to install continuous emission monitoring systems for sulfur dioxide. Facilities which use low sulfur fuel as a means of complying with the sulfur dioxide standard may use a continuous sulfur dioxide monitor or fuel analysis. For facilities that elect to use fuel analysis procedures, fuels are not required to be sampled or analyzed for preparation of reports of excess emissions until the Agency finalizes the procedures and requirements.

Three commentators recommended that carbon dioxide continuous monitoring systems be allowed as an alternative for oxygen monitoring for measurement of the amount of diluents in flue gases from steam generators. The Agency agrees with this recommendation and has included a provision which allows the use of carbon dioxide monitors. This provision allows the use of pollutant monitors that produce data on a wet basis without requiring additional equipment or procedures for correction of data to a dry basis. Where CO_2 or O_2 data are not collected on a consistent basis (wet or dry) with the pollutant data, or where oxygen is measured on a wet basis, alternative procedures to provide corrections for stack moisture and excess air must be approved by the Administrator. Similarly, use of a carbon dioxide continuous monitoring system downstream of a flue gas desulfurization system is not permitted without the Administrator's prior approval due to the potential for absorption of CO_2 within the control device. It should be noted that when any fuel is fired directly in the stack gases for reheating, the F and F_c factors promulgated herein must be prorated based upon the total heat input of the fuels fired within the facility regardless of the locations of fuel firing. Therefore, any facility using a flue gas desulfurization system may be limited to dry basis monitoring instrumentation due to the restrictions on use of a CO_2 diluent monitor unless water vapor is also measured subject to the Administrator's approval.

Two commentators requested that an additional factor (F_w) be developed for use with oxygen continuous monitoring systems that measure flue gas diluents on a wet basis. A factor of this type was evaluated by EPA, but is not being promulgated with the regulations herein. The error in the accuracy of the factor may exceed ±5 percent without additional measurements to correct for variations in flue gas moisture content due to fluctuations in ambient humidity or fuel moisture content. However, EPA will approve installation of wet basis oxygen systems on a case-by-case basis if the owner or operator will proposed use of additional measurements and procedures to control the accuracy of the F_w factor within acceptable limits. Applications for approval of such systems should include the frequency and type of additional measurements proposed and the resulting accuracy of the F_w factor under the extremes of operating conditions anticipated.

One commentator stated that the proposed requirements for recording heat input are superfluous because this information is not needed to convert monitoring data to units of the applicable standard. EPA has reevaluated this requirement and has determined that the conversion of excess emissions into units of the standards will be based upon the F factors and that measurement of the rates of fuel firing will not be needed except when combinations of fuels are fired. Accordingly, the regulations promulgated herein require such measurements only when multiple fuels are fired.

Thirteen commentators questioned the rationale for the proposed increased operating temperature of the Method 5 sampling train for fossil-fuel-fired steam generator particulate testing and the basis for raising rather than lowering the temperature. A brief discussion of the rationale behind this revision was provided in the preamble to the proposed regulations, and a more detailed discussion is provided here. Several factors are of primary importance in developing the data base for a standard of performance and in specifying the reference method for use in conducting a performance test, including:

a. The method used for data gathering to establish a standard must be the same as, or must have a known relationship to, the method subsequently established as the reference method.

b. The method should measure pollutant emissions indicative of the performance of the best systems of emission reduction. A method meeting this criterion will not necessarily measure emissions as they would exist after dilution and cooling to ambient temperature and pressure, as would occur upon release to the atmosphere. As such, an emission factor obtained through use of such a method would, for example, not necessarily be of use in an ambient dispersion model. This seeming inconsistency results from the fact that standards of performance are intended to result in installation of systems of emission reduction which are consistent with best demonstrated technology, considering cost. The Administrator, in establishing such standards, is required to identify best demonstrated technology and to develop standards which reflect such technology. In order for these standards to be meaningful, and for the required control technology to be predictable, the compliance methods must measure emissions which are indicative of the performance of such systems.

c. The method should include sufficient detail as needed to produce consistent and reliable test results.

EPA relies primarily upon Method 5 for gathering a consistent data base for particulate matter standards. Method 5 meets the above criteria by providing detailed sampling methodology and includes an out-of-stack filter to facilitate temperature control. The latter is needed to define particulate matter on a common basis since it is a function of temperature and is not an absolute quantity. If temperature is not controlled, and/or if the effect of temperature upon particulate formation is unknown, the effect on an emission control limitation for particulate matter may be variable and unpredictable.

Although selection of temperature can be varied from industry to industry, EPA specifies a nominal sampling temperature of 120° C for most source categories subject to standards of performance. Reasons for selection of 120° C include the following:

a. Filter temperature must be held above 100° C at sources where moist gas streams are present. Below 100° C, condensation can occur with resultant plugging of filters and possible gas/liquid reactions. A temperature of 120° C allows for expected temperature variation within the train, without dropping below 100° C

b. Matter existing in particulate form at 120° C is indicative of the performance of the best particulate emission reduction systems for most industrial processes. These include systems of emission reduction that may involve not only the final control device, but also the process and stack gas conditioning systems.

c. Adherence to one established temperature (even though some variation may be needed for some source categories) allows comparison of emissions from source category to source category. This limited standardization used in the development of standards of performance is a benefit to equipment vendors and to source owners by providing a consistent basis for comparing test results and predicting control system performance. In comparison, in-stack filtration takes place at stack temperature, which usually is not constant from one source to the next. Since the temperature varies, in-stack filtration does not necessarily provide a consistent definition of particulate matter and does not allow for comparison of various systems of control. On these bases, Method 5 with a sampling filter temperature controlled at approximately 120° C was promulgated as the applicable test method for new fossil-fuel fired steam generators.

Subsequent to the promulgation of the standards of performance for steam generators, data became available indicating that certain combustion products which do not exist as particulate matter at the elevated temperatures existing in steam generator stacks may be collected by Method 5 at lower temperatures (below 160° C). Such material, existing in gaseous form at stack temperature, would not be controllable by emission reduction systems involving electrostatic precipitators (ESP). Consequently, measurement of such condensible matter would not be indicative of the control system performance. Studies conducted in the past two years have confirmed that such condensation can occur. At sources where fuels containing 0.3 to 0.85 percent sulfur were burned, the incremental increase in particulate matter concentration resulting from sampling at 120° C as compared to about 150° C was found to be variable, ranging from 0.001 to 0.008 gr/scf. The variability is not necessarily predictable, since total sulfur oxide concentration, boiler design and operation, and fuel additives each appear to have a potential effect. Based upon these data, it is concluded that the potential increase in particulate concentration at sources meeting the standard of performance for sulfur oxides is not a serious problem in comparison with the particulate standard which is approximately 0.07 gr/scf. Nevertheless, to insure that an unusual case will not occur where a high concentration of condensible matter, not controllable with an ESP, would prevent attainment of the particulate standard, the sampling temperature allowed at fossil-fuel fired steam boilers is being raised to 160° C. Since this temperature is attainable at new steam generator stacks, sampling at temperatures above 160° C would not yield results necessarily representative of the capabilities of the best systems of emission reduction.

In evaluating particulate sampling techniques and the effect of sampling temperature, particular attention has also been given to the possibility that SO_2 may react in the front half of the Method 5 train to form particulate matter. Based upon a series of comprehensive tests involving both source and controlled environments, EPA has developed data that show such reactions do not occur to a significant degree.

Several control agencies commented on the increase in sampling temperature and suggested that the need is for sampling at lower, not higher, temperatures. This is a relevant comment and is one which must be considered in terms of the basis upon which standards are established.

For existing boilers which are not subject to this standard, the existence of higher stack temperatures and/or the use of higher sulfur fuels may result in significant condensation and resultant high indicated particulate concentrations when sampling is conducted at 120° C. At one coal fired steam generator burning coal containing approximately three percent sulfur, EPA measurements at 120° C showed an increase of 0.05 gr/dscf over an average of seven runs compared to samples collected at approximately 150° C. It is believed that this increase resulted, in large part, if not totally, from SO_3 condensation which would occur also when the stack emissions are released into the atmosphere. Therefore, where standards are based upon emission reduction to achieve ambient air quality standards rather than on control technology (as is the case with the standards promulgated herein), a lower sampling temperature may be appropriate.

Seven commentators questioned the need for traversing for oxygen at 12 points within a duct during performance tests. This requirement, which is being revised to apply only when particulate sampling is performed (no more than 12 points are required) is included to insure that potential stratification resulting from air in-leakage will not adversely affect the accuracy of the particulate test.

Eight commentators stated that the requirement for continuous monitoring of nitrogen oxides should be deleted because only two air quality control regions have ambient levels of nitrogen dioxide that exceed the national ambient air quality standard for nitrogen dioxide. Standards of performance issued under section 111 of the Act are designed to require affected facilities to design and install the best systems of emission reduction (taking into account the cost of such reduction). Continuous emission monitoring systems are required to insure that the emission control systems are operated and maintained properly. Because of this, the Agency does not feel that it is appropriate to delete the continuous emission monitoring system requirements for nitrogen oxides; however, in evaluating these comments the Agency found that some situations may exist where the nitrogen oxides monitor is not necessary to insure proper operation and maintenance. The quantity of nitrogen oxides emitted from certain types of furnaces is considerably below the nitrogen oxides emission limitation. The low emission level is achieved through the design of the furnace and does not require specific operating procedures or maintenance on a continuous basis to keep the nitrogen oxides emissions below the applicable standard. Therefore, in this situation, a continuous emission monitoring system for nitrogen oxides is unnecessary. The regulations promulgated herein do not require continuous emission monitoring systems for nitrogen oxides on facilities whose emissions are 30 percent or more below the applicable standard.

Three commentators requested that owners or operators of steam generators be permitted to use NO_x continuous monitoring systems capable of measuring only nitric oxide (NO) since the amount of nitrogen dioxide (NO_2) in the flue gases is comparatively small. The regulations proposed and those promulgated herein allow use of such systems or any system meeting all of the requirements of Performance Specification 2 of Appendix B. A system that measures only nitric oxide (NO) may meet these specifications including the relative accuracy requirement (relative to the reference method tests which measure $NO + NO_2$) without modification. However, in the interests of maximizing the accuracy of the system and creating conditions favorable to acceptance of such systems (the cost of systems measuring only NO is less), the owner or operator may determine the proportion of NO_2 relative to NO in the flue gases and use a factor to adjust the continuous monitoring system emission data (e.g. $1.03 \times NO = NO_x$) provided that the factor is applied not only to the performance evaluation data, but also applied consistently to all data generated by the continuous monitoring system thereafter. This procedure is limited to facilities that have less than 10 percent NO_2 (greater than 90 percent NO) in order to not seriously impair the accuracy of the system due to NO_2 to NO proportion fluctuations.

Section 60.45(g)(1) has been reserved for the future specification of the excess emissions for opacity that must be reported. On November 12, 1974 (39 FR 39872), the Administrator promulgated revisions to Subpart A, General Provisions, pertaining to the opacity provisions and to Reference Method 9, Visual Determination of the Opacity of Emissions from Stationary Sources. On April 22, 1975 (40 FR 17778), the Agency issued a notice soliciting comments on the opacity provisions and Reference Method 9. The Agency intends to evaluate the comments received and make any appropriate revision to the opacity provisions and Reference Method 9. In addition, the Agency is evaluating the opacity standards for fossil-fuel fired steam generators under § 60.42(a)(2) to determine if changes are needed because of the new Reference Method 9. The provisions on excess emissions for opacity will be issued after the Agency completes its evaluation of the opacity standard.

(3) Subpart G—Nitric Acid Plants. Two commentators questioned the long-term validity of the proposed conversion procedures for reducing data to units of the standard. They suggested that the conversion could be accomplished by monitoring the flue gas volumetric rate. EPA reevaluated the proposed procedures and found that monitoring the flue gas volume would be the most direct method and would also be an accurate method of converting monitoring data, but would require the installation of an additional continuous monitoring system. Although this option is available and would be acceptable subject to the Administrator's approval, EPA does not believe that the additional expense this method (monitoring volumetric rate) would entail is warranted. Since nitric acid plants, for economic and technical reasons, typically operate within a fairly narrow range of conversion efficiencies (90–96 percent) and tail gas diluents (2–5 percent oxygen), the flue gas volumetric rates are reasonably proportional to the acid production rate. The error that would be introduced into the data from the maximum variation of these parameters is approximately 15 percent and would usually be much less. It is expected that the tail gas oxygen concentration (an indication of the degree of tail gas dilution) will be rigidly controlled at facilities using catalytic converter control equipment. Accordingly, the proposed procedures for data conversion have been retained due to the small benefit that would result from requiring additional monitoring equipment. Other procedures may be approved by the Administrator under § 60.13(i).

(4) Subpart H—Sulfuric Acid Plants. Two commentators stated that the proposed procedure for conversion of monitoring data to units of the standard would result in large data reduction errors. EPA has evaluated more closely the operations of sulfuric acid plants and agrees that the proposed procedure is inadequate. The proposed conversion procedure assumes that the operating conditions of the affected facility will remain approximately the same as during the continuous monitoring system evaluation tests. For sulfuric acid plants this assumption is invalid. A sulfuric acid plant is typically designed to operate at a constant volumetric throughput (scfm). Acid production rates are altered by by-passing portions of the process air around the furnace or combustor to vary the concentration of the gas entering the converter. This procedure produces widely varying amounts of tail gas dilution relative to the production rate. Accordingly, EPA has developed new conversion procedures whereby the appropriate conversion factor is computed from an analysis of the SO_2 concentration entering the converter. Air injection plants must make additional corrections for the diluent air added. Measurement of the inlet SO_2 is a normal quality control procedure used by most sulfuric acid plants and does not represent an additional cost burden. The Reich test or other suitable procedures may be used.

(5) Subpart J—Petroleum Refineries. One commentator stated that the requirements for installation of continuous monitoring systems for oxygen and firebox temperature are unnecessary and that installation of a flame detection device would be superior for process control purposes. Also, EPA has obtained data which show no identifiable relationship between furnace temperature, percent oxygen in the flue gas, and carbon monoxide emissions when the facility is operated in compliance with the applicable standard. Since firebox temperature and oxygen measurements may not be preferred by source owners and operators for process control, and no

known method is available for translation of these measurements into quantitative reports of excess carbon monoxide emissions, this requirement appears to be of little use to the affected facilities or to EPA. Accordingly, requirements for installation of continuous monitoring systems for measurements of firebox temperature and oxygen are deleted from the regulations.

Since EPA has not yet developed performance specifications for carbon monoxide or hydrogen sulfide continuous monitoring systems, the type of equipment that may be installed by an owner or operator in compliance with EPA requirements is undefined. Without conducting performance evaluations of such equipment, little reliance can be placed upon the value of any data such systems would generate. Therefore, the sections of the regulation requiring these systems are being reserved until EPA proposes performance specifications applicable to H_2S and CO monitoring systems. The provisions of § 60.105(a)(3) do not apply to an owner or operator electing to monitor H_2S. In that case, an H_2S monitor should not be installed until specific H_2S monitoring requirements are promulgated. At the time specifications are proposed, all owners or operators who have not entered into binding contractual obligations to purchase continuous monitoring equipment by [redacted] [23] will be required to install a carbon monoxide continuous monitoring system and a hydrogen sulfide continuous monitoring system (unless a sulfur dioxide continuous monitoring system has been installed) as applicable.

Section 60.105(a)(2), which specifies the excess emissions for opacity that must be reported, has been reserved for the same reasons discussed under fossil fuel-fired steam generators. [23]

(6) Appendix B—Performance Specifications. A large number of comments were received in reference to specific technical and editorial changes needed in the specifications. Each of these comments has been reviewed and several changes in format and procedures have been made. These include adding alignment procedures for opacity monitors and more specific instructions for selecting a location for installing the monitoring equipment. Span requirements have been specified so that commercially produced equipment may be standardized where possible. The format of the specifications was simplified by redefining the requirements in terms of percent opacity, or oxygen, or carbon dioxide, or percent of span. The proposed requirements were in terms of percent of the emission standard which is less convenient or too vague since reference to the emission standards would have represented a range of pollutant concentrations depending upon the amount of diluents (i.e. excess air and water vapor) that are present in the effluent. In order to calibrate gaseous monitors in terms of a specific concentration, the requirements were revised to delete reference to the emission standards.

Four commentators noted that the reference methods used to evaluate continuous monitoring system performance may be less accurate than the systems themselves. Five other commentators questioned the need for 27 nitrogen oxides reference method tests. The accuracy specification for gaseous monitoring systems was specified at 20 percent, a value in excess of the actual accuracy of monitoring systems that provides tolerance for reference method inaccuracy. Commercially available monitoring equipment has been evaluated using these procedures and the combined errors (i.e. relative accuracy) in the reference methods and the monitoring systems have been shown not to exceed 20 percent after the data are averaged by the specified procedures.

Twenty commentators noted that the cost estimates contained in the proposal did not fully reflect installation costs, data reduction and recording costs, and the costs of evaluating the continuous monitoring systems. As a result, EPA reevaluated the cost analysis. For opacity monitoring alone, investment costs including data reduction equipment and performance tests are approximately $20,000, and annual operating costs are approximately $8,500. The same location on the stack used for conducting performance tests with Reference Method 5 (particulate) may be used by installing a separate set of ports for the monitoring system so that no additional expense for access is required. For power plants that are required to install opacity, nitrogen oxides, sulfur dioxide, and diluent (O_2 or CO_2) monitoring systems, the investment cost is approximately $55,000, and the operating cost is approximately $30,000. These are significant costs but are not unreasonable in comparison to the approximately seven million dollar investment cost for the smallest steam generation facility affected by these regulations.

Effective date. These regulations are promulgated under the authority of sections 111, 114 and 301(a) of the Clean Air Act as amended [42 U.S.C. 1857c-6, 1857c-9, and 1857g(a)] and become effective October 6, 1975.

Dated: September 23, 1975.

JOHN QUARLES,
Acting Administrator

40 CFR Part 60 is amended by revising Subparts A, D, F, G, H, I, J, L, M, and O, and adding Appendix B as follows:

1. The table of sections is amended by revising Subpart A and adding Appendix B as follows:

Subpart A—General Provisions

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60.13 Monitoring requirements.

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APPENDIX B—PERFORMANCE SPECIFICATIONS

Performance Specification 1—Performance specifications and specification test procedures for transmissometer systems for continuous measurement of the opacity of stack emissions.

Performance Specification 2—Performance specifications and specification test procedures for monitors of SO_2 and NO_x from stationary sources.

Performance Specification 3—Performance specifications and specification test procedures for monitors of CO_2 and O_2 from stationary sources.

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Subpart A—General Provisions

Section 60.2 is amended by revising paragraph (r) and by adding paragraphs (x), (y), and (z) as follows:

§ 60.2 Definitions.

* * * * *

(r) "One-hour period" means any 60 minute period commencing on the hour.

* * * * *

(x) "Six-minute period" means any one of the 10 equal parts of a one-hour period.

(y) "Continuous monitoring system" means the total equipment, required under the emission monitoring sections in applicable subparts, used to sample and condition (if applicable), to analyze, and to provide a permanent record of emissions or process parameters.

(z) "Monitoring device" means the total equipment, required under the monitoring of operations sections in applicable subparts, used to measure and record (if applicable) process parameters.

3. In § 60.7, paragraph (a)(5) is added and paragraphs (b), (c), and (d) are revised. The added and revised provisions read as follows:

§ 60.7 Notification and record keeping.

(a) * * *

(5) A notification of the date upon which demonstration of the continuous monitoring system performance commences in accordance with § 60.13(c). Notification shall be postmarked not less than 30 days prior to such date.

(b) Any owner or operator subject to the provisions of this part shall maintain records of the occurrence and duration of any startup, shutdown, or malfunction in the operation of an affected facility; any malfunction of the air pollution control equipment; or any periods during which a continuous monitoring system or monitoring device is inoperative.

(c) Each owner or operator required to install a continuous monitoring system shall submit a written report of excess emissions (as defined in applicable subparts) to the Administrator for every calendar quarter. All quarterly reports shall be postmarked by the 30th day following the end of each calendar quarter and shall include the following information:

(1) The magnitude of excess emissions computed in accordance with § 60.13(h), any conversion factor(s) used, and the date and time of commencement and completion of each time period of excess emissions.

(2) Specific identification of each period of excess emissions that occurs during startups, shutdowns, and malfunctions of the affected facility. The nature and cause of any malfunction (if known), the corrective action taken or preventative measures adopted

(3) The date and time identifying each period during which the continuous monitoring system was inoperative except for zero and span checks and the nature of the system repairs or adjustments.

(4) When no excess emissions have occurred or the continuous monitoring system(s) have not been inoperative, repaired, or adjusted, such information shall be stated in the report.

(d) Any owner or operator subject to the provisions of this part shall maintain a file of all measurements, including continuous monitoring system, monitoring device, and performance testing measurements; all continuous monitoring system performance evaluations; all continuous monitoring system or monitoring device calibration checks; adjustments and maintenance performed on these systems or devices; and all other information required by this part recorded in a permanent form suitable for inspection. The file shall be retained for at least two years following the date of such measurements, maintenance, reports, and records.

4. A new § 60.13 is added as follows:

§ 60.13 Monitoring requirements.

(a) Unless otherwise approved by the Administrator or specified in applicable subparts, the requirements of this section shall apply to all continuous monitoring systems required under applicable subparts.

(b) All continuous monitoring systems and monitoring devices shall be installed and operational prior to conducting performance tests under § 60.8. Verification of operational status shall, as a minimum, consist of the following:

(1) For continuous monitoring systems referenced in paragraph (c)(1) of this section, completion of the conditioning period specified by applicable requirements in Appendix B.

(2) For continuous monitoring systems referenced in paragraph (c)(2) of this section, completion of seven days of operation.

(3) For monitoring devices referenced in applicable subparts, completion of the manufacturer's written requirements or recommendations for checking the operation or calibration of the device.

(c) During any performance tests required under § 60.8 or within 30 days thereafter and at such other times as may be required by the Administrator under section 114 of the Act, the owner or operator of any affected facility shall conduct continuous monitoring system performance evaluations and furnish the Administrator within 60 days thereof two or, upon request, more copies of a written report of the results of such tests. These continuous monitoring system performance evaluations shall be conducted in accordance with the following specifications and procedures:

(1) Continuous monitoring systems listed within this paragraph except as provided in paragraph (c)(2) of this section shall be evaluated in accordance with the requirements and procedures contained in the applicable performance specification of Appendix B as follows:

(i) Continuous monitoring systems for measuring opacity of emissions shall comply with Performance Specification 1.

(ii) Continuous monitoring systems for measuring nitrogen oxides emissions shall comply with Performance Specification 2.

(iii) Continuous monitoring systems for measuring sulfur dioxide emissions shall comply with Performance Specification 2.

(iv) Continuous monitoring systems for measuring the oxygen content or carbon dioxide content of effluent gases shall comply with Performance Specification 3.

(2) An owner or operator who, prior to September 11, 1974, entered into a binding contractual obligation to purchase specific continuous monitoring system components except as referenced by paragraph (c)(2)(iii) of this section shall comply with the following requirements:

(i) Continuous monitoring systems for measuring opacity of emissions shall be capable of measuring emission levels within ±20 percent with a confidence level of 95 percent. The Calibration Error Test and associated calculation procedures set forth in Performance Specification 1 of Appendix B shall be used for demonstrating compliance with this specification.

(ii) Continuous monitoring systems for measurement of nitrogen oxides or sulfur dioxide shall be capable of measuring emission levels within ±20 percent with a confidence level of 95 percent. The Calibration Error Test, the Field Test for Accuracy (Relative), and associated operating and calculation procedures set forth in Performance Specification 2 of Appendix B shall be used for demonstrating compliance with this specification.

(iii) Owners or operators of all continuous monitoring systems installed on an affected facility prior to [date of promulgation] are not required to conduct tests under paragraphs (c)(2)(i) and/or (ii) of this section unless requested by the Administrator.

(3) All continuous monitoring systems referenced by paragraph (c)(2) of this section shall be upgraded or replaced (if necessary) with new continuous monitoring systems, and such improved systems shall be demonstrated to comply with applicable performance specifications under paragraph (c)(1) of this section by September 11, 1979.

(d) Owners or operators of all continuous monitoring systems installed in accordance with the provisions of this part shall check the zero and span drift at least once daily in accordance with the method prescribed by the manufacturer of such systems unless the manufacturer recommends adjustments at shorter intervals, in which case such recommendations shall be followed. The zero and span shall, as a minimum, be adjusted whenever the 24-hour zero drift or 24-hour calibration drift limits of the applicable performance specifications in Appendix B are exceeded. For continuous monitoring systems measuring opacity of emissions, the optical surfaces exposed to the effluent gases shall be cleaned prior to performing the zero or span drift adjustments except that for systems using automatic zero adjustments, the optical surfaces shall be cleaned when the cumulative automatic zero compensation exceeds four percent opacity. Unless otherwise approved by the Administrator, the following procedures, as applicable, shall be followed:

(1) For extractive continuous monitoring systems measuring gases, minimum procedures shall include introducing applicable zero and span gas mixtures into the measurement system as near the probe as is practical. Span and zero gases certified by their manufacturer to be traceable to National Bureau of Standards reference gases shall be used whenever these reference gases are available. The span and zero gas mixtures shall be the same composition as specified in Appendix B of this part. Every six months from date of manufacture, span and zero gases shall be reanalyzed by conducting triplicate analyses with Reference Methods 6 for SO_2, 7 for NO_x, and 3 for O_2 and CO_2, respectively. The gases may be analyzed at less frequent intervals if longer shelf lives are guaranteed by the manufacturer.

(2) For non-extractive continuous monitoring systems measuring gases, minimum procedures shall include upscale check(s) using a certified calibration gas cell or test cell which is functionally equivalent to a known gas concentration. The zero check may be performed by computing the zero value from upscale measurements or by mechanically producing a zero condition.

(3) For continuous monitoring systems measuring opacity of emissions, minimum procedures shall include a method for producing a simulated zero opacity condition and an upscale (span) opacity condition using a certified neutral density filter or other related technique to produce a known obscuration of the light beam. Such procedures shall provide a system check of the analyzer internal optical surfaces and all electronic circuitry including the lamp and photodetector assembly.

(e) Except for system breakdowns, repairs, calibration checks, and zero and span adjustments required under paragraph (d) of this section, all continuous monitoring systems shall be in continuous operation and shall meet minimum frequency of operation requirements as follows:

(1) All continuous monitoring systems referenced by paragraphs (c)(1) and (2) of this section for measuring opacity of emissions shall complete a minimum of one cycle of operation (sampling, analyzing, and data recording) for each successive 10-second period.

(2) All continuous monitoring systems referenced by paragraph (c)(1) of this section for measuring oxides of nitrogen, sulfur dioxide, carbon dioxide, or oxygen shall complete a minimum of one cycle of operation (sampling, analyzing, and data recording) for each successive 15-minute period.

(3) All continuous monitoring systems referenced by paragraph (c)(2) of this section, except opacity, shall complete a minimum of one cycle of operation (sampling, analyzing, and data recording) for each successive one-hour period.

(f) All continuous monitoring systems or monitoring devices shall be installed such that representative measurements of emissions or process parameters from the affected facility are obtained. Additional procedures for location of continuous monitoring systems contained in the applicable Performance Specifications of Appendix B of this part shall be used.

(g) When the effluents from a single affected facility or two or more affected facilities subject to the same emission standards are combined before being released to the atmosphere, the owner or operator may install applicable continuous monitoring systems on each effluent or on the combined effluent. When the affected facilities are not subject to the same emission standards, separate continuous monitoring systems shall be installed on each effluent. When the effluent from one affected facility is released to the atmosphere through more than one point, the owner or operator shall install applicable continuous monitoring systems on each separate effluent unless the installation of fewer systems is approved by the Administrator.

(h) Owners or operators of all continuous monitoring systems for measurement of opacity shall reduce all data to six-minute averages and for systems other than opacity to one-hour averages for time periods under § 60.2 (x) and (r) respectively. Six-minute opacity averages shall be calculated from 24 or more data points equally spaced over each six-minute period. For systems other than opacity, one-hour averages shall be computed from four or more data points equally spaced over each one-hour period. Data recorded during periods of system breakdowns, repairs, calibration checks, and zero and span adjustments shall not be included in the data averages computed under this paragraph. An arithmetic or integrated average of all data may be used. The data output of all continuous monitoring systems may be recorded in reduced or nonreduced form (e.g. ppm pollutant and percent O_2 or lb/million Btu of pollutant). All excess emissions shall be converted into units of the standard using the applicable conversion procedures specified in subparts. After conversion into units of the standard, the data may be rounded to the same number of significant digits used in subparts to specify the applicable standard (e.g., rounded to the nearest one percent opacity).

(1) Upon written application by an owner or operator, the Administrator may approve alternatives to any monitoring procedures or requirements of this part including, but not limited to the following:

(i) Alternative monitoring requirements when installation of a continuous monitoring system or monitoring device specified by this part would not provide accurate measurements due to liquid water or other interferences caused by substances with the effluent gases.

(ii) Alternative monitoring requirements when the affected facility is infrequently operated.

(iii) Alternative monitoring requirements to accommodate continuous monitoring systems that require additional measurements to correct for stack moisture conditions.

(iv) Alternative locations for installing continuous monitoring systems or monitoring devices when the owner or operator can demonstrate that installation at alternate locations will enable accurate and representative measurements.

(v) Alternative methods of converting pollutant concentration measurements to units of the standards.

(vi) Alternative procedures for performing daily checks of zero and span drift that do not involve use of span gases or test cells.

(vii) Alternatives to the A.S.T.M. test methods or sampling procedures specified by any subpart.

(viii) Alternative continuous monitoring systems that do not meet the design or performance requirements in Performance Specification 1, Appendix B, but adequately demonstrate a definite and consistent relationship between its measurements and the measurements of opacity by a system complying with the requirements in Performance Specification 1. The Administrator may require that such demonstration be performed for each affected facility.

(ix) Alternative monitoring requirements when the effluent from a single affected facility or the combined effluent from two or more affected facilities are released to the atmosphere through more than one point.

Subpart D—Standards of Performance for Fossil Fuel-Fired Steam Generators

§ 60.42 [Amended]

5. Paragraph (a)(2) of § 60.42 is amended by deleting the second sentence.

6. Section 60.45 is amended by revising paragraphs (a), (b), (c), (d), (e), (f), and (g) as follows:

§ 60.45 Emission and fuel monitoring.

(a) A continuous monitoring system for measuring the opacity of emissions, except where gaseous fuel is the only fuel burned, shall be installed, calibrated, maintained, and operated by the owner or operator. The continuous monitoring system shall be spanned at 80 or 90 or 100 percent opacity.

(b) A continuous monitoring system for measuring sulfur dioxide emissions, shall be installed, calibrated, maintained and operated by the owner or operator except where gaseous fuel is the only fuel burned or where low sulfur fuels are used to achieve compliance with the standard under § 60.43 and fuel analyses under paragraph (b)(2) of this section are conducted. The following procedures shall be used for monitoring sulfur dioxide emissions:

(1) For affected facilities which use continuous monitoring systems, Reference Method 6 shall be used for conducting monitoring system performance evaluations under § 60.13(c). The pollutant gas used to prepare calibration gas mixtures under paragraph 2.1, Performance Specification 2 and for calibration checks under § 60.13(d) to this part, shall be sulfur dioxide (SO_2). The span value for the continuous monitoring system shall be determined as follows:

(i) For affected facilities firing liquid fossil fuel the span value shall be 1000 ppm sulfur dioxide.

(ii) For affected facilities firing solid fossil fuel the span value shall be 1500 ppm sulfur dioxide.

(iii) For affected facilities firing fossil fuels in any combination, the span value shall be determined by computation in accordance with the following formula and rounding to the nearest 500 ppm sulfur dioxide:

$$1000y + 1500z$$

where:

y = the fraction of total heat input derived from liquid fossil fuel, and

z = the fraction of total heat input derived from solid fossil fuel.

(iv) For affected facilities which fire both fossil fuels and nonfossil fuels, the span value shall be subject to the Administrator's approval.

(2) [Reserved]

(3) For affected facilities using flue gas desulfurization systems to achieve compliance with sulfur dioxide standards under § 60.43, the continuous monitoring system for measuring sulfur dioxide emissions shall be located downstream of the desulfurization system and in accordance with requirements in Performance Specification 2 of Appendix B and the following:

(i) Owners or operators shall install CO_2 continuous monitoring systems, if selected under paragraph (d) of this section, at a location upstream of the desulfurization system. This option may be used only if the owner or operator can demonstrate that air is not added to the flue gas between the CO_2 continuous monitoring system and the SO_2 continuous monitoring system and each system measures the CO_2 and SO_2 on a dry basis.

(ii) Owners or operators who install O_2 continuous monitoring systems under paragraph (d) of this section shall select a location downstream of the desulfurization system and all measurements shall be made on a dry basis.

(iii) If fuel of a different type than is used in the boiler is fired directly into the flue gas for any purpose (e.g., reheating) the F or Fc factors used shall be prorated under paragraph (f)(6) of this section with consideration given to the fraction of total heat input supplied by the additional fuel. The pollutant, opacity, CO_2, or O_2 continuous monitoring system(s) shall be installed downstream of any location at which fuel is fired directly into the flue gas.

(c) A continuous monitoring system for the measurement of nitrogen oxides emissions shall be installed, calibrated, maintained, and operated by the owner or operator except for any affected facility demonstrated during performance tests under § 60.8 to emit nitrogen oxides pollutants at levels 30 percent or more below applicable standards under § 60.44 of this part. The following procedures shall be used for determining the span and for calibrating nitrogen oxides continuous monitoring systems:

(1) The span value shall be determined as follows:

(i) For affected facilities firing gaseous fossil fuel the span value shall be 500 ppm nitrogen oxides.

(ii) For affected facilities firing liquid fossil fuel the span value shall be 500 ppm nitrogen oxides.

(iii) For affected facilities firing solid fossil fuel the span value shall be 1000 ppm nitrogen oxides.

(iv) For affected facilities firing fossil fuels in any combination, the span value shall be determined by computation in accordance with the following formula and rounding to the nearest 500 ppm nitrogen oxides:

$$500(x+y)+1000z$$

where:

x = the fraction of total heat input derived from gaseous fossil fuel,
y = the fraction of total heat input derived from liquid fossil fuel, and
z = the fraction of total heat input derived from solid fossil fuel.

(v) For affected facilities which fire both fossil fuels and nonfossil fuels, the span value shall be subject to the Administrator's approval.

(2) The pollutant gas used to prepare calibration gas mixtures under paragraph 2.1, Performance Specification 2 and for calibration checks under § 60.13(d) to this part, shall be nitric oxide (NO). Reference Method 7 shall be used for conducting monitoring system performance evaluations under § 60.13(c).

(d) A continuous monitoring system for measuring either oxygen or carbon dioxide in the flue gases shall be installed, calibrated, maintained, and operated by the owner or operator.

(e) An owner or operator required to install continuous monitoring systems under paragraphs (b) and (c) of this section shall for each pollutant monitored use the applicable conversion procedure for the purpose of converting continuous monitoring data into units of the applicable standards (g/million cal, lb/million Btu) as follows:

(1) When the owner or operator elects under paragraph (d) of this section to measure oxygen in the flue gases, the measurement of the pollutant concentration and oxygen concentration shall each be on a dry basis and the following conversion procedure shall be used:

$$E=CF\left(\frac{20.9}{20.9-\%O_2}\right)$$

where:

E, C, F and $\%O_2$ are determined under paragraph (f) of this section.

(2) When the owner or operator elects under paragraph (d) of this section to measure carbon dioxide in the flue gases, the measurement of the pollutant concentration and the carbon dioxide concentration shall be on a consistent basis (wet or dry) and the following conversion procedure shall be used:

$$E=CF_c\left[\frac{100}{\%\,CO_2}\right]$$

where:

E, C, F_c, and $\%CO_2$ are determined under paragraph (f) of this section.

(f) The values used in the equations under paragraphs (e) (1) and (2) of this section are derived as follows:

(1) E = pollutant emission, g/million cal (lb/million Btu).

(2) C = pollutant concentration, g/dscm (lb/dscf), determined by multiplying the average concentration (ppm) for each one-hour priod by 4.15×10^{-5} M g/dscm per ppm (2.59×10^{-9} M lb/dscf per ppm) where M = pollutant molecular weight, g/g-mole (lb/lb-mole). M = 64.07 for sulfur dioxide and 46.01 for nitrogen oxides.

(3) $\%O_2$, $\%CO_2$ = oxygen or carbon dioxide volume (expressed as percent), determined with equipment specified under paragraph (d) of this section.

(4) F, F_c = a factor representing a ratio of the volume of dry flue gases generated to the calorific value of the fuel combusted (F), and a factor representing a ratio of the volume of carbon dioxide generated to the calorific value of of the fuel combusted (F_c), respectively. Values of F and F_c are given as follows:

(i) For anthracite coal as classified according to A.S.T.M. D388-66, F=1.139 dscm/million cal (10140 dscf/million Btu) and F_c=0.222 scm CO_2/million cal (1980 scf CO_2/million Btu).

(ii) For sub-bituminous and bituminous coal as classified according to ASTM D388-66, F=1.103 dscm/million cal (9820 dscf/million Btu) and F_c=0.203 scm CO_2/million cal (1810 scf CO_2/million Btu).

(iii) For liquid fossil fuels including crude, residual, and distillate oils, F=1.036 dscm/million cal (9220 dscf/million Btu) and F_c=0.161 scm CO_2/million cal (1430 scf CO_2/million Btu).

(iv) For gaseous fossil fuels, F=0.982 dscm/million cal (8740 dscf/million Btu). For natural gas, propane, and butane fuels, F_c=0.117 scm CO_2/million cal (1040 scf CO_2/million Btu) for natural gas, 0.135 scm CO_2/million cal (1200 scf CO_2/million Btu) for propane, and 0.142 scm CO_2/million cal (1260 scf CO_2/million Btu) for butane.

(5) The owner or operator may use the following equation to determine an F factor (dscm/million cal, or dscf/million Btu) on a dry basis (if it is desired to calculate F on a wet basis, consult with the Administrator) or F_c factor (scm CO_2/ million cal, or scf CO_2/million Btu) on either basis in lieu of the F or F_c factors specified in paragraph (f)(4) of this section:

$$F=\left[\frac{227.0\%H+95.7\%C+35.4\%S+8.6\%N-28.5\%O}{GCV}\right]\ \text{(metric units)}$$

$$F=\frac{10^6\,[5.34\%H+1.53\%C+0.57\%S+0.14\%N-0.46\%O]}{GCV}\ \text{(English units)}$$

$$F_c=\frac{20.0\%C}{GCV}\ \text{(metric units)}$$

$$F_c=\frac{321\times10^3\%C}{GCV}\ \text{(English units)}$$

(i) H, C, S, N, and O are content by weight of hydrogen, carbon, sulfur, nitrogen, and oxygen (expressed as percent), respectively, as determined on the same basis as GCV by ultimate analysis of the fuel fired, using A.S.T.M. method D3178-74 or D3176 (solid fuels), or computed from results using A.S.T.M. methods D1137-53(70), D1945-64(73), or D1946-67(72) (gaseous fuels) as applicable.

(ii) GCV is the gross calorific value (cal/g, Btu/lb) of the fuel combusted, determined by the A.S.T.M. test methods D2015-66(72) for solid fuels and D1826-64(70) for gaseous fuels as applicable.

(6) For affected facilities firing combinations of fossil fuels, the F or F_c factors determined by paragraphs (f) (4) or (5) of this section shall be prorated in accordance with the applicable formula as follows:

(i) $$F=xF_1+yF_2+zF_3$$

where:

x, y, z = the fraction of total heat input derived from gaseous, liquid, and solid fuel, respectively.
F_1, F_2, F_3 = the value of F for gaseous, liquid, and solid fossil fuels respectively under paragraphs (f) (4) or (5) of this section.

(ii) $$F_c=\sum_{i=1}^{n}X_i(F_c)_i$$

where:

X_i = the fraction of total heat input derived from each type fuel (e.g., natural gas, butane, crude, bituminous coal, etc.).
$(F_c)_i$ = the applicable F_c factor for each fuel type determined in accordance with paragraphs (f)(4) and (5) of this section.

(iii) For affected facilities which fire both fossil fuels and nonfossil fuels, the F or F_c value shall be subject to the Administrator's approval.

(g) For the purpose of reports required under § 60.7(c), periods of excess emissions that shall be reported are defined as follows:

(1) [Reserved]

(2) Sulfur dioxide. Excess emissions for affected facilities are defined as:

(i) Any three-hour period during which the average emissions (arithmetic average of three contiguous one-hour periods) of sulfur dioxide as measured by a continuous monitoring system exceed the applicable standard under § 60.43.

(ii) [Reserved]

(3) Nitrogen oxides. Excess emissions for affected facilities using a continuous monitoring system for measuring nitro-

gen oxides are defined as any three-hour period during which the average emissions (arithmetic average of three contiguous one-hour periods) exceed the applicable standards under § 60.44.

7. Section 60.46 is revised to read as follows:

§ 60.46 Test methods and procedures.

(a) The reference methods in Appendix A of this part, except as provided in § 60.8(b), shall be used to determine compliance with the standards as prescribed in §§ 60.42, 60.43, and 60.44 as follows:

(1) Method 1 for selection of sampling site and sample traverses.

(2) Method 3 for gas analysis to be used when applying Reference Methods 5, 6 and 7.

(3) Method 5 for concentration of particulate matter and the associated moisture content.

(4) Method 6 for concentration of SO_2, and

(5) Method 7 for concentration of NOx.

(b) For Method 5, Method 1 shall be used to select the sampling site and the number of traverse sampling points. The sampling time for each run shall be at least 60 minutes and the minimum sampling volume shall be 0.85 dscm (30 dscf) except that smaller sampling times or volumes, when necessitated by process variables or other factors, may be approved by the Administrator. The probe and filter holder heating systems in the sampling train shall be set to provide a gas temperature no greater than 160° C (320° F).

(c) For Methods 6 and 7, the sampling site shall be the same as that selected for Method 5. The sampling point in the duct shall be at the centroid of the cross section or at a point no closer to the walls than 1 m (3.28 ft). For Method 6, the sample shall be extracted at a rate proportional to the gas velocity at the sampling point.

(d) For Method 6, the minimum sampling time shall be 20 minutes and the minimum sampling volume 0.02 dscm (0.71 dscf) for each sample. The arithmetic mean of two samples shall constitute one run. Samples shall be taken at approximately 30-minute intervals.

(e) For Method 7, each run shall consist of at least four grab-samples taken at approximately 15-minute intervals. The arithmetic mean of the samples shall constitute the run value.

(f) For each run using the methods specified by paragraphs (a) (3), (4), and (5) of this section, the emissions expressed in g/million cal (lb/million Btu) shall be determined by the following procedure:

$$E = CF\left(\frac{20.9}{20.9 - \%O_2}\right)$$

where:

(1) E = pollutant emission g/million cal (lb/million Btu).

(2) C = pollutant concentration, g/dscm (lb/dscf), determined by Methods 5, 6, or 7.

(3) $\%O_2$ = oxygen content by volume (expressed as percent), dry basis. Percent oxygen shall be determined by using the integrated or grab sampling and analysis procedures of Method 3 as applicable. The sample shall be obtained as follows:

(i) For determination of sulfur dioxide and nitrogen oxides emissions, the oxygen sample shall be obtained simultaneously at the same point in the duct as used to obtain the samples for Methods 6 and 7 determinations, respectively [§ 60.46(c)]. For Method 7, the oxygen sample shall be obtained using the grab sampling and analysis procedures of Method 3.

(ii) For determination of particulate emissions, the oxygen sample shall be obtained simultaneously by traversing the duct at the same sampling location used for each run of Method 5 under paragraph (b) of this section. Method 1 shall be used for selection of the number of traverse points except that no more than 12 sample points are required.

(4) F = a factor as determined in paragraphs (f) (4), (5) or (6) of § 60.45.

(g) When combinations of fossil fuels are fired, the heat input, expressed in cal/hr (Btu/hr), shall be determined during each testing period by multiplying the gross calorific value of each fuel fired by the rate of each fuel burned. Gross calorific value shall be determined in accordance with A.S.T.M. methods D2015–66(72) (solid fuels), D240–64(73) (liquid fuels), or D1826–64(70) (gaseous fuels) as applicable. The rate of fuels burned during each testing period shall be determined by suitable methods and shall be confirmed by a material balance over the steam generation system.

Subpart F—Standards of Performance for Portland Cement Plants

§ 60.62 [Amended]

8. Section 60.62 is amended by deleting paragraph (d).

Subpart G—Standards of Performance for Nitric Acid Plants

§ 60.72 [Amended]

9. Paragraph (a)(2) of § 60.72 is amended by deleting the second sentence.

10. Section 60.73 is amended by revising paragraphs (a), (b), (c), and (e) to read as follows:

§ 60.73 Emission monitoring.

(a) A continuous monitoring system for the measurement of nitrogen oxides shall be installed, calibrated, maintained, and operated by the owner or operator. The pollutant gas used to prepare calibration gas mixtures under paragraph 2.1, Performance Specification 2 and for calibration checks under § 60.13(d) to this part, shall be nitrogen dioxide (NO_2). The span shall be set at 500 ppm of nitrogen dioxide. Reference Method 7 shall be used for conducting monitoring system performance evaluations under § 60.13(c).

(b) The owner or operator shall establish a conversion factor for the purpose of converting monitoring data into units of the applicable standard (kg/metric ton, lb/short ton). The conversion factor shall be established by measuring emissions with the continuous monitoring system concurrent with measuring emissions with the applicable reference method tests. Using only that portion of the continuous monitoring emission data that represents emission measurements concurrent with the reference method test periods, the conversion factor shall be determined by dividing the reference method test data averages by the monitoring data averages to obtain a ratio expressed in units of the applicable standard to units of the monitoring data, i.e., kg/metric ton per ppm (lb/short ton per ppm). The conversion factor shall be reestablished during any performance test under § 60.8 or any continuous monitoring system performance evaluation under § 60.13(c).

(c) The owner or operator shall record the daily production rate and hours of operation.

* * * * *

(e) For the purpose of reports required under § 60.7(c), periods of excess emissions that shall be reported are defined as any three-hour period during which the average nitrogen oxides emissions (arithmetic average of three contiguous one-hour periods) as measured by a continuous monitoring system exceed the standard under § 60.72(a).

Subpart H—Standards of Performance for Sulfuric Acid Plants

§ 60.83 [Amended]

11. Paragraph (a)(2) of § 60.83 is amended by deleting the second sentence

12. Section 60.84 is amended by revising paragraphs (a), (b), (c), and (e) to read as follows:

§ 60.84 Emission monitoring.

(a) A continuous monitoring system for the measurement of sulfur dioxide shall be installed, calibrated, maintained, and operated by the owner or operator. The pollutant gas used to prepare calibration gas mixtures under paragraph 2.1, Performance Specification 2 and for calibration checks under § 60.13(d) to this part, shall be sulfur dioxide (SO_2). Reference Method 8 shall be used for conducting monitoring system performance evaluations under § 60.13(c) except that only the sulfur dioxide portion of the Method 8 results shall be used. The span shall be set at 1000 ppm of sulfur dioxide.

(b) The owner or operator shall establish a conversion factor for the purpose of converting monitoring data into units of the applicable standard (kg/metric ton, lb/short ton). The conversion factor shall be determined, as a minimum, three times daily by measuring the concentration of sulfur dioxide entering the converter using suitable methods (e.g., the Reich test, National Air Pollution Control Administration Publication No. 999–AP–13 and calculating the appropriate conversion factor for each eight-hour period as follows:

$$CF = k\left[\frac{1.000 - 0.015r}{r - s}\right]$$

where:

CF = conversion factor (kg/metric ton per ppm, lb/short ton per ppm).

k = constant derived from material balance. For determining CF in metric units, $k=0.0653$. For determining CF in English units, $k=0.1306$.

r = percentage of sulfur dioxide by volume entering the gas converter. Appropriate corrections must be made for air injection plants subject to the Administrator's approval.

s = percentage of sulfur dioxide by volume in the emissions to the atmosphere determined by the continuous monitoring system required under paragraph (a) of this section.

(c) The owner or operator shall record all conversion factors and values under paragraph (b) of this section from which they were computed (i.e., CF, r, and s).

* * * * *

(e) For the purpose of reports under § 60.7(c), periods of excess emissions shall be all three-hour periods (or the arithmetic average of three consecutive one-hour periods) during which the integrated average sulfur dioxide emissions exceed the applicable standards under § 60.82.

Subpart I—Standards of Performance for Asphalt Concrete Plants

§ 60.92 [Amended]

13. Paragraph (a)(2) of § 60.92 is amended by deleting the second sentence.

Subpart J—Standards of Performance for Petroleum Refineries

§ 60.102 [Amended]

14. Paragraph (a)(2) of § 60.102 is amended by deleting the second sentence.

15. Section 60.105 is amended by revising paragraphs (a), (b), and (e) to read as follows:

§ 60.105 Emission monitoring.

(a) Continuous monitoring systems shall be installed, calibrated, maintained, and operated by the owner or operator as follows:

(1) A continuous monitoring system for the measurement of the opacity of emissions discharged into the atmosphere from the fluid catalytic cracking unit catalyst regenerator. The continuous monitoring system shall be spanned at 60, 70, or 80 percent opacity.

(2) [Reserved]

(3) A continuous monitoring system for the measurement of sulfur dioxide in the gases discharged into the atmosphere from the combustion of fuel gases (except where a continuous monitoring system for the measurement of hydrogen sulfide is installed under paragraph (a)(4) of this section). The pollutant gas used to prepare calibration gas mixtures under paragraph 2.1, Performance Specification 2 and for calibration checks under § 60.13(d) to this part, shall be sulfur dioxide (SO_2). The span shall be set at 100 ppm. For conducting monitoring system performance evaluations under § 60.13(c), Reference Method 6 shall be used.

(4) [Reserved]

(b) [Reserved]

* * * * *

(e) For the purpose of reports under § 60.7(c), periods of excess emissions that shall be reported are defined as follows:

(1) [Reserved]

(2) [Reserved]

(3) [Reserved]

(4) Any six-hour period during which the average emissions (arithmetic average of six contiguous one-hour periods) of sulfur dioxide as measured by a continuous monitoring system exceed the standard under § 60.104.

Subpart L—Standards of Performance for Secondary Lead Smelters

§ 60.122 [Amended]

16. Section 60.122 is amended by deleting paragraph (c).

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Subpart M—Standards of Performance for Secondary Brass and Bronze Ingot Production Plants

§ 60.132 [Amended]

17. Section 60.132 is amended by deleting paragraph (c).

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Subpart O—Standards of Performance for Sewage Treatment Plants

§ 60.152 [Amended]

18. Paragraph (a)(2) of § 60.152 is amended by deleting the second sentence.

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19. Part 60 is amended by adding Appendix B as follows:

APPENDIX B—PERFORMANCE SPECIFICATIONS

Performance Specification 1—Performance specifications and specification test procedures for transmissometer systems for continuous monitoring system exceed the emissions.

1. Principle and Applicability.

1.1 Principle. The opacity of particulate matter in stack emissions is measured by a continuously operating emission measurement system. These systems are based upon the principle of transmissometry which is a direct measurement of the attenuation of visible radiation (opacity) by particulate matter in a stack effluent. Light having specific spectral characteristics is projected from a lamp across the stack of a pollutant source to a light sensor. The light is attenuated due to absorption and scatter by the particulate matter in the effluent. The percentage of visible light attenuated is defined as the opacity of the emission. Transparent stack emissions that do not attenuate light will have a transmittance of 100 or an opacity of 0. Opaque stack emissions that attenuate all of the visible light will have a transmittance of 0 or an opacity of 100 percent. The transmissometer is evaluated by use of neutral density filters to determine the precision of the continuous monitoring system. Tests of the system are performed to determine zero drift, calibration drift, and response time characteristics of the system.

1.2 Applicability. This performance specification is applicable to the continuous monitoring systems specified in the subparts for measuring opacity of emissions. Specifications for continuous measurement of visible emissions are given in terms of design, performance, and installation parameters. These specifications contain test procedures, installation requirements, and data computation procedures for evaluating the acceptability of the continuous monitoring systems subject to approval by the Administrator.

2. Apparatus.

2.1 Calibrated Filters. Optical filters with neutral spectral characteristics and known optical densities to visible light or screens known to produce specified optical densities. Calibrated filters with accuracies certified by the manufacturer to within ±3 percent opacity shall be used. Filters required are low, mid, and high-range filters with nominal optical densities as follows when the transmissometer is spanned at opacity levels specified by applicable subparts:

Span value (percent opacity)	Calibrated filter optical densities with equivalent opacity in parenthesis		
	Low-range	Mid-range	High-range
50	0.1 (20)	0.2 (37)	0.3 (50)
60	.1 (20)	.2 (37)	.3 (50)
70	.1 (20)	.3 (50)	.4 (60)
80	.1 (20)	.3 (50)	.6 (75)
90	.1 (20)	.4 (60)	.7 (80)
100	.1 (20)	.4 (60)	.9 (87½)

It is recommended that filter calibrations be checked with a well-collimated photopic transmissometer of known linearity prior to use. The filters shall be of sufficient size to attenuate the entire light beam of the transmissometer.

22. Data Recorder. Analog chart recorder or other suitable device with input voltage range compatible with the analyzer system output. The resolution of the recorder's data output shall be sufficient to allow completion of the test procedures within this specification.

2.3 Opacity measurement System. An in-stack transmissometer (folded or single path) with the optical design specifications designated below, associated control units and apparatus to keep optical surfaces clean.

3. Definitions.

3.1 Continuous Monitoring System. The total equipment required for the determination of pollutant opacity in a source effluent. Continuous monitoring systems consist of major subsystems as follows:

3.1.1 Sampling Interface. The portion of a continuous monitoring system for opacity that protects the analyzer from the effluent.

3.1.2 Analyzer. That portion of the continuous monitoring system which senses the pollutant and generates a signal output that is a function of the pollutant opacity.

3.1.3 Data Recorder. That portion of the continuous monitoring system that processes the analyzer output and provides a permanent record of the output signal in terms of pollutant opacity.

3.2 Transmissometer. The portions of a continuous monitoring system for opacity that include the sampling interface and the analyzer.

3.3 Span. The value of opacity at which the continuous monitoring system is set to produce the maximum data display output. The span shall be set at an opacity specified in each applicable subpart.

3.4 Calibration Error. The difference between the opacity reading indicated by the continuous monitoring system and the known values of a series of test standards. For this method the test standards are a series of calibrated optical filters or screens.

3.5 Zero Drift. The change in continuous monitoring system output over a stated period of time of normal continuous operation when the pollutant concentration at the time of the measurements is zero.

3.6 Calibration Drift. The change in the continuous monitoring system output over a stated period of time of normal continuous operation when the pollutant concentration at the time of the measurements is the same known upscale value.

3.7 System Response. The time interval from a step change in opacity in the stack at the input to the continuous monitoring system to the time at which 95 percent of the corresponding final value is reached as displayed on the continuous monitoring system data recorder.

3.8 Operational Test Period. A minimum period of time over which a continuous monitoring system is expected to operate within certain performance specifications without unscheduled maintenance, repair, or adjustment.

3.9 Transmittance. The fraction of incident light that is transmitted through an optical medium of interest.

3.10 Opacity. The fraction of incident light that is attenuated by an optical medium of interest. Opacity (O) and transmittance (T) are related as follows:

$$O = 1 - T$$

3.11 Optical Density. A logarithmic measure of the amount of light that it attenuated by an optical medium of interest. Optical density (D) is related to the transmittance and opacity as follows:

$D = -\log_{10} T$

$D = -\log_{10} (1-0)$

3.12 Peak Optical Response. The wavelength of maximum sensitivity of the instrument.

3.13 Mean Spectral Response. The wavelength which bisects the total area under the curve obtained pursuant to paragraph 9.2.1.

3.14 Angle of View. The maximum (total) angle of radiation detection by the photodetector assembly of the analyzer.

3.15 Angle of Projection. The maximum (total) angle that contains 95 percent of the radiation projected from the lamp assembly of the analyzer.

3.16 Pathlength. The depth of effluent in the light beam between the receiver and the transmitter of the single-pass transmissometer, or the depth of effluent between the transceiver and reflector of a double-pass transmissometer. Two pathlengths are referenced by this specification:

3.16.1 Monitor Pathlength. The depth of effluent at the installed location of the continuous monitoring system.

3.16.2 Emission Outlet Pathlength. The depth of effluent at the location emissions are released to the atmosphere.

4. Installation Specification.

4.1 Location. The transmissometer must be located across a section of duct or stack that will provide a particulate matter flow through the optical volume of the transmissometer that is representative of the particulate matter flow through the duct or stack. It is recommended that the monitor pathlength or depth of effluent for the transmissometer include the entire diameter of the duct or stack. In installations using a shorter pathlength, extra caution must be used in determining the measurement location representative of the particulate matter flow through the duct or stack.

4.1.1 The transmissometer location shall be downstream from all particulate control equipment.

4.1.2 The transmissometer shall be located as far from bends and obstructions as practical.

4.1.3 A transmissometer that is located in the duct or stack following a bend shall be installed in the plane defined by the bend where possible.

4.1.4 The transmissometer should be installed in an accessible location.

4.1.5 When required by the Administrator, the owner or operator of a source must demonstrate that the transmissometer is located in a section of duct or stack where a representative particulate matter distribution exists. The determination shall be accomplished by examining the opacity profile of the effluent at a series of positions across the duct or stack while the plant is in operation at maximum or reduced operating rates or by other tests acceptable to the Administrator.

4.2 Slotted Tube. Installations that require the use of a slotted tube shall use a slotted tube of sufficient size and blackness so as not to interfere with the free flow of effluent through the entire optical volume of the transmissometer or reflect light into the transmissometer photodetector. Light reflections may be prevented by using blackened baffles within the slotted tube to prevent the lamp radiation from impinging upon the tube walls, by restricting the angle of projection of the light and the angle of view of the photodetector assembly to less than the cross-sectional area of the slotted tube, or by other methods. The owner or operator must show that the manufacturer of the monitoring system has used appropriate methods to minimize light reflections for systems using slotted tubes.

4.3 Data Recorder Output. The continuous monitoring system output shall permit expanded display of the span opacity on a standard 0 to 100 percent scale. Since all opacity standards are based on the opacity of the effluent exhausted to the atmosphere, the system output shall be based upon the emission outlet pathlength and permanently recorded. For affected facilities whose monitor pathlength is different from the facility's emission outlet pathlength, a graph shall be provided with the installation to show the relationships between the continuous monitoring system recorded opacity based upon the emission outlet pathlength and the opacity of the effluent at the analyzer location (monitor pathlength). Tests for measurement of opacity that are required by this performance specification are based upon the monitor pathlength. The graph necessary to convert the data recorder output to the monitor pathlength basis shall be established as follows:

$$\log (1-0_2) = (1_1/1_2 \log (1-0_1)$$

where:

0_1 = the opacity of the effluent based upon 1_1.

0_2 = the opacity of the effluent based upon 1_2.

1_1 = the emission outlet pathlength.

1_2 = the monitor pathlength.

5. Optical Design Specifications.

The optical design specifications set forth in Section 6.1 shall be met in order for a measurement system to comply with the requirements of this method.

6. Determination of Conformance with Design Specifications.

6.1 The continuous monitoring system for measurement of opacity shall be demonstrated to conform to the design specifications set forth as follows:

6.1.1 Peak Spectral Response. The peak spectral response of the continuous monitoring systems shall occur between 500 nm and 600 nm. Response at any wavelength below 400 nm or above 700 nm shall be less than 10 percent of the peak response of the continuous monitoring system.

6.1.2 Mean Spectral Response. The mean spectral response of the continuous monitoring system shall occur between 500 nm and 600 nm.

6.1.3 Angle of View. The total angle of view shall be no greater than 5 degrees.

6.1.4 Angle of Projection. The total angle of projection shall be no greater than 5 degress.

6.2 Conformance with requirements under Section 6.1 of this specification may be demonstrated by the owner or operator of the affected facility or by the manufacturer of the opacity measurement system. Where conformance is demonstrated by the manufacturer, certification that the tests were performed, a description of the test procedures, and the test results shall be provided by the manufacturer. If the source owner or operator demonstrates conformance, the procedures used and results obtained shall be reported.

6.3 The general test procedures to be followed to demonstrate conformance with Section 6 requirements are given as follows: (These procedures will not be applicable to all designs and will require modification in some cases. Where analyzer and optical design is certified by the manufacturer to conform with the angle of view or angle of projection specifications, the respective procedures may be omitted.)

6.3.1 Spectral Response. Obtain spectral data for detector, lamp, and filter components used in the measurement system from their respective manufacturers.

6.3.2 Angle of View. Set the received up as specified by the manufacturer. Draw an arc with radius of 3 meters. Measure the receiver response to a small (less than 3 centimeters) non-directional light source at 5-centimeter intervals on the arc for 26 centimeters on either side of the detector centerline. Repeat the test in the vertical direction.

6.3.3 Angle of Projection. Set the projector up as specified by the manufacturer. Draw an arc with radius of 3 meters. Using a small photoelectric light detector (less than 3 centimeters), measure the light intensity at 5-centimeter intervals on the arc for 26 centimeters on either side of the light source centerline of projection. Repeat the test in the vertical direction.

7. Continuous Monitoring System Performance Specifications.

The continuous monitoring system shall meet the performance specifications in Table 1-1 to be considered acceptable under this method.

TABLE 1-1.—*Performance specifications*

Parameter	*Specifications*
a. .Calibration error	≤3 pct opacity.[1]
b Zero drift (24 h)	≤2 pct opacity.[1]
c.Calibration drift (24 h)	≤2 pct opacity.[1]
d. Response time	10 s (maximum).
e. Operational test perioc	168 h.

[1] Expressed as sum of absolute mean value and the 95 pct confidence interval of a series of tests.

8. Performance Specification Test Procedures. The following test procedures shall be used to determine conformance with the requirements of paragraph 7:

8.1 Calibration Error and Response Time Test. These tests are to be performed prior to installation of the system on the stack and may be performed at the affected facility or at other locations provided that proper notification is given. Set up and calibrate the measurement system as specified by the manufacturer's written instructions for the monitor pathlength to be used in the installation. Span the analyzer as specified in applicable subparts.

8.1.1 Calibration Error Test. Insert a series of calibration filters in the transmissometer path at the midpoint. A minimum of three calibration filters (low, mid, and high-range) selected in accordance with the table under paragraph 2.1 and calibrated within 3 percent must be used. Make a total of five nonconsecutive readings for each filter.

Record the measurement system output readings in percent opacity. (See Figure 1-1.)

8.1.2 System Response Test. Insert the high-range filter in the transmissometer path five times and record the time required for the system to respond to 95 percent of final zero and high-range filter values. (See Figure 1-2.)

8.2 Field Test for Zero Drift and Calibration Drift. Install the continuous monitoring system on the affected facility and perform the following alignments:

8.2.1 Preliminary Alignments. As soon as possible after installation and once a year thereafter when the facility is not in operation, perform the following optical and zero alignments:

8.2.1.1 Optical Alignment. Align the light beam from the transmissometer upon the optical surfaces located across the effluent (i.e., the retroflector or photodetector as applicable) in accordance with the manufacturer's instructions.

8.2.1.2 Zero Alignment. After the transmissometer has been optically aligned and the transmissometer mounting is mechanically stable (i.e., no movement of the mounting due to thermal contraction of the stack, duct, etc.) and a clean stack condition has been determined by a steady zero opacity condition, perform the zero alignment. This alignment is performed by balancing the continuous monitor system response so that any simulated zero check coincides with an actual zero check performed across the monitor pathlength of the clean stack.

8.2.1.3 Span. Span the continuous monitoring system at the opacity specified in subparts and offset the zero setting at least 10 percent of span so that negative drift can be quantified.

8.2.2. Final Alignments. After the preliminary alignments have been completed and the affected facility has been started up and reaches normal operating temperature, recheck the optical alignment in accordance with 8.2.1.1 of this specification. If the alignment has shifted, realign the optics, record any detectable shift in the opacity measured by the system that can be attributed to the optical realignment, and notify the Administrator. This condition may not be objectionable if the affected facility operates within a fairly constant and adequately narrow range of operating temperatures that does not produce significant shifts in optical alignment during normal operation of the facility. Under circumstances where the facility operations produce fluctuations in the effluent gas temperature that result in significant misalignments, the Administrator may require improved mounting structures or another location for installation of the transmissometer.

8.2.3 Conditioning Period. After completing the post-startup alignments, operate the system for an initial 168-hour conditioning period in a normal operational manner.

8.2.4 Operational Test Period. After completing the conditioning period, operate the system for an additional 168-hour period retaining the zero offset. The system shall monitor the source effluent at all times except when being zeroed or calibrated. At 24-hour intervals the zero and span shall be checked according to the manufacturer's instructions. Minimum procedures used shall provide a system check of the analyzer internal mirrors and all electronic circuitry including the lamp and photodetector assembly and shall include a procedure for producing a simulated zero opacity condition and a simulated upscale (span) opacity condition as viewed by the receiver. The manufacturer's written instructions may be used providing that they equal or exceed these minimum procedures. Zero and span the transmissometer, clean all optical surfaces exposed to the effluent, realign optics, and make any necessary adjustments to the calibration of the system daily. These zero and calibration adjustments and optical realignments are allowed only at 24-hour intervals or at such shorter intervals as the manufacturer's written instructions specify. Automatic corrections made by the measurement system without operator intervention are allowable at any time. The magnitude of any zero or span drift adjustments shall be recorded. During this 168-hour operational test period, record the following at 24-hour intervals: (a) the zero reading and span readings after the system is calibrated (these readings should be set at the same value at the beginning of each 24-hour period); (b) the zero reading after each 24 hours of operation, but before cleaning and adjustment; and (c) the span reading after cleaning and zero adjustment, but before span adjustment. (See Figure 1-3.)

9. Calculation, Data Analysis, and Reporting.

9.1 Procedure for Determination of Mean Values and Confidence Intervals.

9.1.1 The mean value of the data set is calculated according to equation 1-1.

$$\bar{x}=\frac{1}{n}\sum_{i=1}^{n}x_i \qquad \text{Equation 1-1}$$

where x_i = absolute value of the individual measurements.

Σ = sum of the individual values.
x = mean value, and
n = number of data points.

9.1.2 The 95 percent confidence interval (two-sided) is calculated according to equation 1-2:

$$C.I._{95}=\frac{t_{.975}}{n\sqrt{n-1}}\sqrt{n\left(\sum x_i^2\right)-\left(\sum x_i\right)^2} \qquad \text{Equation 1-2}$$

where

$\sum x_i$ = sum of all data points,
$t_{.975}=t_1-\alpha/2$, and
$C.I._{95}$ = 95 percent confidence interval estimate of the average mean value.

Values for $t_{.975}$

n	$t_{.975}$	n	$t_{.975}$
2	12.706	10	2.262
3	4.303	11	2.228
4	3.182	12	2.201
5	2.776	13	2.179
6	2.571	14	2.160
7	2.447	15	2.145
8	2.365	16	2.131
9	2.306		

The values in this table are already corrected for n-1 degrees of freedom. Use n equal to the number of samples as data points.

9.2 Data Analysis and Reporting.

9.2.1 Spectral Response. Combine the spectral data obtained in accordance with paragraph 6.3.1 to develop the effective spectral response curve of the transmissometer. Report the wavelength at which the peak response occurs, the wavelength at which the mean response occurs, and the maximum response at any wavelength below 400 nm and above 700 nm expressed as a percentage of the peak response as required under paragraph 6.2.

9.2.2 Angle of View. Using the data obtained in accordance with paragraph 6.3.2, calculate the response of the receiver as a function of viewing angle in the horizontal and vertical directions (26 centimeters of arc with a radius of 3 meters equal 5 degrees). Report relative angle of view curves as required under paragraph 6.2.

9.2.3 Angle of Projection. Using the data obtained in accordance with paragraph 6.3.3, calculate the response of the photoelectric detector as a function of projection angle in the horizontal and vertical directions. Report relative angle of projection curves as required under paragraph 6.2.

9.2.4 Calibration Error. Using the data from paragraph 8.1 (Figure 1-1), subtract the known filter opacity value from the value shown by the measurement system for each of the 15 readings. Calculate the mean and 95 percent confidence interval of the five different values at each test filter value according to equations 1-1 and 1-2. Report the sum of the absolute mean difference and the 95 percent confidence interval for each of the three test filters.

9.2.5 Zero Drift. Using the zero opacity values measured every 24 hours during the field test (paragraph 8.2), calculate the differences between the zero point after cleaning, aligning, and adjustment, and the zero value 24 hours later just prior to cleaning, aligning, and adjustment. Calculate the mean value of these points and the confidence interval using equations 1-1 and 1-2. Report the sum of the absolute mean value and the 95 percent confidence interval.

9.2.6 Calibration Drift. Using the span value measured every 24 hours during the field test, calculate the differences between the span value after cleaning, aligning, and adjustment of zero and span, and the span value 24 hours later just after cleaning, aligning, and adjustment of zero and before adjustment of span. Calculate the mean value of these points and the confidence interval using equations 1-1 and 1-2. Report the sum of the absolute mean value and the confidence interval.

9.2.7 Response Time. Using the data from paragraph 8.1, calculate the time interval from filter insertion to 95 percent of the final stable value for all upscale and downscale traverses. Report the mean of the 10 upscale and downscale test times.

9.2.8 Operational Test Period. During the 168-hour operational test period, the continuous monitoring system shall not require any corrective maintenance, repair, replacement, or adjustment other than that clearly specified as required in the manufacturer's operation and maintenance manuals as routine and expected during a one-week period. If the continuous monitoring system is operated within the specified performance parameters and does not require corrective maintenance, repair, replacement, or adjustment other than as specified above during the 168-hour test period, the operational test period shall have been successfully concluded. Failure of the continuous monitoring system to meet these requirements shall call for a repetition of the 168-hour test period. Portions of the tests which were satisfactorily completed need not be repeated. Failure to meet any performance specification(s) shall call for a repetition of the one-week operational test period and that specific portion of the tests required by paragraph 8 related to demonstrating compliance with the failed specification. All maintenance and adjustments required shall be recorded. Output readings shall be recorded before and after all adjustments.

10. References.

10.1 "Experimental Statistics," Department of Commerce, National Bureau of Standards Handbook 91, 1963, pp. 3-31, paragraphs 3-3.1.4.

10.2 "Performance Specifications for Stationary-Source Monitoring Systems for Gases and Visible Emissions," Environmental Protection Agency, Research Triangle Park, N.C., EPA-650/2-74-013, January 1974.

Calibrated Neutral Density Filter Data
(See paragraph 8.1.1)

Low Range ____% opacity
Mid Range ___% opacity
High Range ___% opacity
Span Value _____% opacity

Date of Test ________________ Location of Test ________________

Calibrated Filter[1]	Analyzer Reading % Opacity	Differences[2] % Opacity
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		

	Low	Mid	High
Mean difference	___	___	___
Confidence interval	___	___	___
Calibration error = Mean Difference[3] + C.I.	___	___	___

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[1] Low, mid or high range

[2] Calibration filter opacity - analyzer reading

[3] Absolute value

Figure 1-1. Calibration Error Test

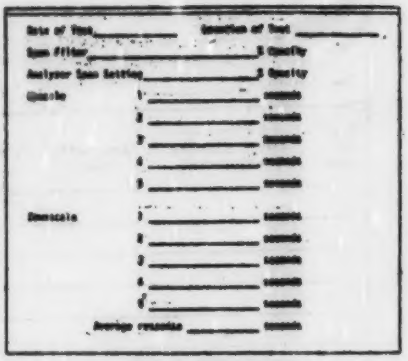

Figure 1-2. Response Time Test

Zero Setting __________ (See paragraph 8.2.1) Date of Test __________

Span Setting __________

Date and Time	Zero Reading (Before cleaning and adjustment)	Zero Drift (ΔZero)	Span Reading (After cleaning and zero adjustment but before span adjustment)	Calibration Drift (ΔSpan)

Zero Drift = Mean Zero Drift* __________ + CI (Zero) __________ = __________.

Calibration Drift = Mean Span Drift* __________ + CI (Span) __________ = __________.

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*Absolute value

Figure 1-3. Zero and Calibration Drift Test

PERFORMANCE SPECIFICATION 2—PERFORMANCE SPECIFICATIONS AND SPECIFICATION TEST PROCEDURES FOR MONITORS OF SO_2 AND NO_X FROM STATIONARY SOURCES

1. Principle and Applicability.

1.1 Principle. The concentration of sulfur dioxide or oxides of nitrogen pollutants in stack emissions is measured by a continuously operating emission measurement system. Concurrent with operation of the continuous monitoring system, the pollutant concentrations are also measured with reference methods (Appendix A). An average of the continuous monitoring system data is computed for each reference method testing period and compared to determine the relative accuracy of the continuous monitoring system. Other tests of the continuous monitoring system are also performed to determine calibration error, drift, and response characteristics of the system.

1.2 Applicability. This performance specification is applicable to evaluation of continuous monitoring systems for measurement of nitrogen oxides or sulfur dioxide pollutants. These specifications contain test procedures, installation requirements, and data computation procedures for evaluating the acceptability of the continuous monitoring systems.

2. Apparatus.

2.1 Calibration Gas Mixtures. Mixtures of known concentrations of pollutant gas in a diluent gas shall be prepared. The pollutant gas shall be sulfur dioxide or the appropriate oxide(s) of nitrogen specified by paragraph 6 and within subparts. For sulfur dioxide gas mixtures, the diluent gas may be air or nitrogen. For nitric oxide (NO) gas mixtures, the diluent gas shall be oxygen-free (<10 ppm) nitrogen, and for nitrogen dioxide (NO_2) gas mixtures the diluent gas shall be air. Concentrations of approximately 50 percent and 90 percent of span are required. The 90 percent gas mixture is used to set and to check the span and is referred to as the span gas.

2.2 Zero Gas. A gas certified by the manufacturer to contain less than 1 ppm of the pollutant gas or ambient air may be used.

2.3 Equipment for measurement of the pollutant gas concentration using the reference method specified in the applicable standard.

2.4 Data Recorder. Analog chart recorder or other suitable device with input voltage range compatible with analyzer system output. The resolution of the recorder's data output shall be sufficient to allow completion of the test procedures within this specification.

2.5 Continuous monitoring system for SO_2 or NO_x pollutants as applicable.

3. Definitions.

3.1 Continuous Monitoring System. The total equipment required for the determination of a pollutant gas concentration in a source effluent. Continuous monitoring systems consist of major subsystems as follows:

3.1.1 Sampling Interface—That portion of an extractive continuous monitoring system that performs one or more of the following operations: acquisition, transportation, and conditioning of a sample of the source effluent or that portion of an in-situ continuous monitoring system that protects the analyzer from the effluent.

3.1.2 Analyzer—That portion of the continuous monitoring system which senses the pollutant gas and generates a signal output that is a function of the pollutant concentration.

3.1.3 Data Recorder—That portion of the continuous monitoring system that provides a permanent record of the output signal in terms of concentration units.

3.2 Span. The value of pollutant concentration at which the continuous monitoring system is set to produce the maximum data display output. The span shall be set at the concentration specified in each applicable subpart.

3.3 Accuracy (Relative). The degree of correctness with which the continuous monitoring system yields the value of gas concentration of a sample relative to the value given by a defined reference method. This accuracy is expressed in terms of error, which is the difference between the paired concentration measurements expressed as a percentage of the mean reference value.

3.4 Calibration Error. The difference between the pollutant concentration indicated by the continuous monitoring system and the known concentration of the test gas mixture.

3.5 Zero Drift. The change in the continuous monitoring system output over a stated period of time of normal continuous operation when the pollutant concentration at the time for the measurements is zero.

3.6 Calibration Drift. The change in the continuous monitoring system output over a stated time period of normal continuous operations when the pollutant concentration at the time of the measurements is the same known upscale value.

3.7 Response Time. The time interval from a step change in pollutant concentration at the input to the continuous monitoring system to the time at which 95 percent of the corresponding final value is reached as displayed on the continuous monitoring system data recorder.

3.8 Operational Period. A minimum period of time over which a measurement system is expected to operate within certain performance specifications without unscheduled maintenance, repair, or adjustment.

3.9 Stratification. A condition identified by a difference in excess of 10 percent between the average concentration in the duct or stack and the concentration at any point more than 1.0 meter from the duct or stack wall.

4. Installation Specifications. Pollutant continuous monitoring systems (SO_2 and NO_x) shall be installed at a sampling location where measurements can be made which are directly representative (4.1), or which can be corrected so as to be representative (4.2) of the total emissions from the affected facility. Conformance with this requirement shall be accomplished as follows:

4.1 Effluent gases may be assumed to be nonstratified if a sampling location eight or more stack diameters (equivalent diameters) downstream of any air in-leakage is selected. This assumption and data correction procedures under paragraph 4.2.1 may not be applied to sampling locations upstream of an air preheater in a stream generating facility under Subpart D of this part. For sampling locations where effluent gases are either demonstrated (4.3) or may be assumed to be nonstratified (eight diameters), a point (extractive systems) or path (in-situ systems) of average concentration may be monitored.

4.2 For sampling locations where effluent gases cannot be assumed to be nonstratified (less than eight diameters) or have been shown under paragraph 4.3 to be stratified, results obtained must be consistently representative (e.g. a point of average concentration may shift with load changes) or the data generated by sampling at a point (extractive systems) or across a path (in-situ systems) must be corrected (4.2.1 and 4.2.2) so as to be representative of the total emissions from the affected facility. Conformance with this requirement may be accomplished in either of the following ways:

4.2.1 Installation of a diluent continuous monitoring system (O_2 or CO_2 as applicable) in accordance with the procedures under paragraph 4.2 of Performance Specification 3 of this appendix. If the pollutant and diluent monitoring systems are not of the same type (both extractive or both in-situ), the extractive system must use a multipoint probe.

4.2.2 Installation of extractive pollutant monitoring systems using multipoint sampling probes or in-situ pollutant monitoring systems that sample or view emissions which are consistently representative of the total emissions for the entire cross section. The Administrator may require data to be submitted to demonstrate that the emissions sampled or viewed are consistently representative for several typical facility process operating conditions.

4.3 The owner or operator may perform a traverse to characterize any stratification of effluent gases that might exist in a stack or duct. If no stratification is present, sampling procedures under paragraph 4.1 may be applied even though the eight diameter criteria is not met.

4.4 When single point sampling probes for extractive systems are installed within the stack or duct under paragraphs 4.1 and 4.2.1, the sample may not be extracted at any point less than 1.0 meter from the stack or duct wall. Multipoint sampling probes installed under paragraph 4.2.2 may be located at any points necessary to obtain consistently representative samples.

5. Continuous Monitoring System Performance Specifications.

The continuous monitoring system shall meet the performance specifications in Table 2-1 to be considered acceptable under this method.

TABLE 2-1.—*Performance specifications*

Parameter	*Specification*
1. Accuracy [1]	≤20 pct of the mean value of the reference method test data.
2. Calibration error [1]	≤ 5 pct of each (50 pct, 90 pct) calibration gas mixture value.
3. Zero drift (2 h) [1]	2 pct of span
4. Zero drift (24 h) [1]	Do.
5. Calibration drift (2 h) [1]	Do.
6. Calibration drift (24 h) [1]	2.[illegible] pct. of span
7. Response time	15 min maximum.
8. Operational period	168 h minimum.

[1] Expressed as sum of absolute mean value plus 95 pct confidence interval of a series of tests.

6. Performance Specification Test Procedures. The following test procedures shall be used to determine conformance with the requirements of paragraph 5. For NO_x an-requirements of paragraph 5. For NO_x analyzers that oxidize nitric oxide (NO) to nitrogen dioxide (NO_2), the response time test under paragraph 6.3 of this method shall be performed using nitric oxide (NO) span gas. Other tests for NO_x continuous monitoring systems under paragraphs 6.1 and 6.2 and all tests for sulfur dioxide systems shall be performed using the pollutant span gas specified by each subpart.

6.1 Calibration Error Test Procedure. Set up and calibrate the complete continuous monitoring system according to the manufacturer's writen instructions. This may be accomplished either in the laboratory or in the field.

6.1.1 Calibration Gas Analyses. Triplicate analyses of the gas mixtures shall be performed within two weeks prior to use using Reference Methods 6 for SO_2 and 7 for NO_x. Analyze each calibration gas mixture (50%, 90%) and record the results on the example sheet shown in Figure 2-1. Each sample test result must be within 20 percent of the averaged result or the tests shall be repeated. This step may be omitted for non-extractive monitors where dynamic calibration gas mixtures are not used (6.1.2).

6.1.2 Calibration Error Test Procedure. Make a total of 15 nonconsecutive measurements by alternately using zero gas and each caliberation gas mixture concentration (e.g., 0%, 50%, 0%, 90%, 50%, 90%, 50%, 0%, etc.). For nonextractive continuous monitoring systems, this test procedure may be performed by using two or more calibration gas cells whose concentrations are certified by the manufacturer to be functionally equivalent to these gas concentrations. Convert the continuous monitoring system output readings to ppm and record the results on the example sheet shown in Figure 2-2.

6.2 Field Test for Accuracy (Relative), Zero Drift, and Calibration Drift. Install and operate the continuous monitoring system in accordance with the manufacturer's written instructions and drawings as follows:

6.2.1 Conditioning Period. Offset the zero setting at least 10 percent of the span so that negative zero drift can be quantified. Operate the system for an initial 168-hour conditioning period in normal operating manner.

6.2.2 Operational Test Period. Operate the continuous monitoring system for an additional 168-hour period retaining the zero offset. The system shall monitor the source effluent at all times except when being zeroed, calibrated, or backpurged.

6.2.2.1 Field Test for Accuracy (Relative). For continuous monitoring systems employing extractive sampling, the probe tip for the continuous monitoring system and the probe tip for the Reference Method sampling train should be placed at adjacent locations in the duct. For NO_x continuous monitoring systems, make 27 NO_x concentration measurements, divided into nine sets, using the applicable reference method. No more than one set of tests, consisting of three individual measurements, shall be performed in any one hour. All individual measurements of each set shall be performed concurrently, or within a three-minute interval and the results averaged. For SO_2 continuous monitoring systems, make nine SO_2 concentration measurements using the applicable reference method. No more than one measurement shall be performed in any one hour. Record the reference method test data and the continuous monitoring system concentrations on the example data sheet shown in Figure 2-3.

6.2.2.2 Field Test for Zero Drift and Calibration Drift. For extractive systems, determine the values given by zero and span gas pollutant concentrations at two-hour intervals until 15 sets of data are obtained. For nonextractive measurement systems, the zero value may be determined by mechanically producing a zero condition that provides a system check of the analyzer internal mirrors and all electronic circuitry including the radiation source and detector assembly or by inserting three or more calibration gas cells and computing the zero point from the upscale measurements. If this latter technique is used, a graph(s) must be retained by the owner or operator for each measurement system that shows the relationship between the upscale measurements and the zero point. The span of the system shall be checked by using a calibration gas cell certified by the manufacturer to be functionally equivalent to 50 percent of span concentration. Record the zero and span measurements (or the computed zero drift) on the example data sheet shown in Figure 2-4. The two-hour periods over which measurements are conducted need not be consecutive but may not overlap. All measurements required under this paragraph may be conducted concurrent with tests under paragraph 6.2.2.1.

6.2.2.3 Adjustments. Zero and calibration corrections and adjustments are allowed only at 24-hour intervals or at such shorter intervals as the manufacturer's written instructions specify. Automatic corrections made by the measurement system without operator intervention or initiation are allowable at any time. During the entire 168-hour operational test period, record on the example sheet shown in Figure 2-5 the values given by zero and span gas pollutant concentrations before and after adjustment at 24-hour intervals.

6.3 Field Test for Response Time.

6.3.1 Scope of Test. Use the entire continuous monitoring system as installed, including sample transport lines if used. Flow rates, line diameters, pumping rates, pressures (do not allow the pressurized calibration gas to change the normal operating pressure in the sample line), etc., shall be at the nominal values for normal operation as specified in the manufacturer's written instructions. If the analyser is used to sample more than one pollutant source (stack), repeat this test for each sampling point.

6.3.2 Response Time Test Procedure. Introduce zero gas into the continuous monitoring system sampling interface or as close to the sampling interface as possible. When the system output reading has stabilized, switch quickly to a known concentration of pollutant gas. Record the time from concentration switching to 95 percent of final stable response. For non-extractive monitors, the highest available calibration gas concentration shall be switched into and out of the sample path and response times recorded. Perform this test sequence three (3) times. Record the results of each test on the example sheet shown in Figure 2-6.

7. Calculations, Data Analysis and Reporting.

7.1 Procedure for determination of mean values and confidence intervals.

7.1.1 The mean value of a data set is calculated according to equation 2-1.

$$\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i \qquad \text{Equation 2-1}$$

where:

x_i = absolute value of the measurements,
Σ = sum of the individual values,
$\bar{x}$ = mean value, and
n = number of data points.

7.1.2 The 95 percent confidence interval (two-sided) is calculated according to equation 2-2:

$$C.I._{95} = \frac{t_{.975}}{n\sqrt{n-1}}\sqrt{n(\sum x_i^2) - (\sum x_i)^2} \qquad \text{Equation 2-2}$$

where:

$\sum x_i$ = sum of all data points,
$t_{.975} = t_1 - \alpha/2$, and
$C.I._{95}$ = 95 percent confidence interval estimate of the average mean value.

Values for $t_{.975}$

	$t_{.975}$
1	12.706
2	4.303
3	3.182
4n	2.776
5	2.571
6	2.447
7	2.365
8	2.306
9	2.262
10	2.228
12	2.201
13	2.179
14	2.160
15	2.145
16	2.131

The values in this table are already corrected for n-1 degrees of freedom. Use n equal to the number of samples as data points.

7.2 Data Analysis and Reporting.

7.2.1 Accuracy (Relative). For each of the nine reference method test points, determine the average pollutant concentration reported by the continuous monitoring system. These average concentrations shall be determined from the continuous monitoring system data recorded under 7.2.2 by integrating or averaging the pollutant concentrations over each of the time intervals concurrent with each reference method testing period. Before proceeding to the next step, determine the basis (wet or dry) of the continuous monitoring system data and reference method test data concentrations. If the bases are not consistent, apply a moisture correction to either reference method concentrations or the continuous monitoring system concentrations as appropriate. Determine the correction factor by moisture tests concurrent with the reference method testing periods. Report the moisture test method and the correction procedure employed. For each of the nine test runs determine the difference for each test run by subtracting the respective reference method test concentrations (use average of each set of three measurements for NO_x) from the continuous monitoring system integrated or averaged concentrations. Using these data, compute the mean difference and the 95 percent confidence interval of the differences (equations 2-1 and 2-2). Accuracy is reported as the sum of the absolute value of the mean difference and the 95 percent confidence interval of the differences expressed as a percentage of the mean reference method value. Use the example sheet shown in Figure 2-3.

7.2.2 Calibration Error. Using the data from paragraph 6.1, subtract the measured pollutant concentration determined under paragraph 6.1.1 (Figure 2-1) from the value shown by the continuous monitoring system for each of the five readings at each concentration measured under 6.1.2 (Figure 2-2). Calculate the mean of these difference values and the 95 percent confidence intervals according to equations 2-1 and 2-2. Report the calibration error (the sum of the absolute value of the mean difference and the 95 percent confidence interval) as a percentage of each respective calibration gas concentration. Use example sheet shown in Figure 2-2.

7.2.3 Zero Drift (2-hour). Using the zero concentration values measured each two hours during the field test, calculate the differences between consecutive two-hour readings expressed in ppm. Calculate the mean difference and the confidence interval using equations 2-1 and 2-2. Report the zero drift as the sum of the absolute mean value and the confidence interval as a percentage of span. Use example sheet shown in Figure 2-4.

7.2.4 Zero Drift (24-hour). Using the zero concentration values measured every 24 hours during the field test, calculate the differences between the zero point after zero adjustment and the zero value 24 hours later just prior to zero adjustment. Calculate the mean value of these points and the confidence interval using equations 2-1 and 2-2. Report the zero drift (the sum of the absolute mean and confidence interval) as a percentage of span. Use example sheet shown in Figure 2-5.

7.2.5 Calibration Drift (2-hour). Using the calibration values obtained at two-hour intervals during the field test, calculate the differences between consecutive two-hour readings expressed as ppm. These values should be corrected for the corresponding zero drift during that two-hour period. Calculate the mean and confidence interval of these corrected difference values using equations 2-1 and 2-2. Do not use the differences between non-consecutive readings. Report the calibration drift as the sum of the absolute mean and confidence interval as a percentage of span. Use the example sheet shown in Figure 2-4.

7.2.6 Calibration Drift (24-hour). Using the calibration values measured every 24 hours during the field test, calculate the differences between the calibration concentration reading after zero and calibration adjustment, and the calibration concentration reading 24 hours later after zero adjustment but before calibration adjustment. Calculate the mean value of these differences and the confidence interval using equations 2-1 and 2-2. Report the calibration drift (the sum of the absolute mean and confidence interval) as a percentage of span. Use the example sheet shown in Figure 2-5.

7.2.7 Response Time. Using the charts from paragraph 6.3, calculate the time interval from concentration switching to 95 percent to the final stable value for all upscale and downscale tests. Report the mean of the three upscale test times and the mean of the three downscale test times. The two average times should not differ by more than 15 percent of the slower time. Report the slower time as the system response time. Use the example sheet shown in Figure 2-6.

7.2.8 Operational Test Period. During the 168-hour performance and operational test period, the continuous monitoring system shall not require any corrective maintenance, repair, replacement, or adjustment other than that clearly specified as required in the operation and maintenance manuals as routine and expected during a one-week period. If the continuous monitoring system operates within the specified performance parameters and does not require corrective maintenance, repair, replacement or adjustment other than as specified above during the 168-hour test period, the operational period will be successfully concluded. Failure of the continuous monitoring system to meet this requirement shall call for a repetition of the 168-hour test period. Portions of the test which were satisfactorily completed need not be repeated. Failure to meet any performance specifications shall call for a repetition of the one-week performance test period and that portion of the testing which is related to the failed specification. All maintenance and adjustments required shall be recorded. Output readings shall be recorded before and after all adjustments.

8. References.

8.1 "Monitoring Instrumentation for the Measurement of Sulfur Dioxide in Stationary Source Emissions," Environmental Protection Agency, Research Triangle Park, N.C., February 1973.

8.2 "Instrumentation for the Determination of Nitrogen Oxides Content of Stationary Source Emissions," Environmental Protection Agency, Research Triangle Park, N.C., Volume 1, APTD-0847, October 1971; Volume 2, APTD-0942, January 1972.

8.3 "Experimental Statistics," Department of Commerce, Handbook 91, 1963, pp. 3-31, paragraphs 3-3.1.4.

8.4 "Performance Specifications for Stationary-Source Monitoring Systems for Gases and Visible Emissions," Environmental Protection Agency, Research Triangle Park, N.C., EPA-650/2-74-013, January 1974.

Date ____________ Reference Method Used ____

Mid-Range Calibration Gas Mixture

Sample 1 ________ppm
Sample 2 ________ppm
Sample 3 ________ppm
Average ________ppm

High-Range (span) Calibration Gas Mixture

Sample 1 ________ppm
Sample 2 ________ppm
Sample 3 ________ppm
Average ________ppm

Figure 2-1. Analysis of Calibration Gas Mixtures

Calibration Gas Mixture Data (From Figure 2-1)

Mid (50%) ______ ppm High (90%) ______ ppm

Run #	Calibration Gas Concentration, ppm	Measurement System Reading, ppm	Differences,[1] ppm
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			

	Mid	High
Mean difference	____	____
Confidence interval	± ____	± ____
Calibration error = $\frac{\text{Mean Difference}^{2} + \text{C.I.}}{\text{Average Calibration Gas Concentration}} \times 100$	____ %	____ %

---

[1] Calibration gas concentration - measurement system reading

[2] Absolute value

Figure 2-2. Calibration Error Determination

Test No.	Date and Time	Reference Method Samples					Analyzer 1-Hour Average (ppm)*		Difference (ppm)	
		SO_2 Sample 1 (ppm)	NO_x Sample 1 (ppm)	NO_x Sample 2 (ppm)	NO_x Sample 3 (ppm)	NO_x Sample Average (ppm)	SO_2	NO_x	SO_2	NO_x
1										
2										
3										
4										
5										
6										
7										
8										
9										

Mean reference method test value (SO_2) ______

Mean reference method test value (NO_x) ______

Average of the differences ______

Mean differences** = ______________ ppm (SO_2), = ______________ ppm (NO_x).

95% Confidence intervals = = ± ______________ ppm (SO_2), = ± ______________ ppm (NO_x).

Accuracies = $\frac{\text{Mean difference (absolute value)} + \text{95\% confidence interval}}{\text{Mean reference method value}} \times 100$ = ____ % (SO_2), = ____ % (NO_x)

* Explain and report method used to determine integrated averages.

** Mean differences = the average of the differences minus the mean reference method test value.

Figure 2-3. Accuracy Determination (SO_2 and NO_x)

Data Set No.	Time Begin	End	Date	Zero Reading	Zero Drift (ΔZero)	Span Reading	Span Drift (ΔSpan)	Calibration Drift (Span- Zero)
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								

Zero Drift = [Mean Zero Drift* ______ + CI (Zero) ______] ÷ [Span] x 100 = ______.
Calibration Drift = [Mean Span Drift* ______ + CI (Span) ______] ÷ [Span] x 100 = ______.
*Absolute Value.

Figure 2-4. Zero and Calibration Drift (2 Hour)

Date and Time	Zero Reading	Zero Drift (ΔZero)	Span Reading (After zero adjustment)	Calibration Drift (ΔSpan)

Zero Drift = [Mean Zero Drift* ______ + C.I. (Zero) ______]
÷ [Instrument Span] x 100 = ______.
Calibration Drift = [Mean Span Drift* ______ + C.I. (Span) ______]
÷ [Instrument Span] x 100 = ______.
* Absolute value

Figure 2-5. Zero and Calibration Drift (24-hour)

Date of Test ____________ _

Span Gas Concentration. __________ppm

Analyzer Span Setting __________ppm

Upscale	1	________seconds
	2	________seconds
	3	________seconds

Average upscale response ________seconds

Downscale	1	________seconds
	2	________seconds
	3	________seconds

Average downscale response ______seconds

System average response time (slower time) = _______seconds

%deviation from slower system average response = $\left[\frac{\text{average upscale minus average downscale}}{\text{slower time}}\right] \times 100\% =$ ____.

Figure 2-6. Response Time

Performance Specification 3—Performance specifications and specification test procedures for monitors of CO$_2$ and O$_2$ from stationary sources.

1. Principle and Applicability.

1.1 Principle. Effluent gases are continuously sampled and are analyzed for carbon dioxide or oxygen by a continuous monitoring system. Tests of the system are performed during a minimum operating period to determine zero drift, calibration drift, and response time characteristics.

1.2 Applicability. This performance specification is applicable to evaluation of continuous monitoring systems for measurement of carbon dioxide or oxygen. These specifications contain test procedures, installation requirements, and data computation procedures for evaluating the acceptability of the continuous monitoring systems subject to approval by the Administrator. Sampling may include either extractive or non-extractive (in-situ) procedures.

2. Apparatus.

2.1 Continuous Monitoring System for Carbon Dioxide or Oxygen.

2.2 Calibration Gas Mixtures. Mixture of known concentrations of carbon dioxide or oxygen in nitrogen or air. Midrange and 90 percent of span carbon dioxide or oxygen concentrations are required. The 90 percent of span gas mixture is to be used to set and check the analyzer span and is referred to as span gas. For oxygen analyzers, if the span is higher than 21 percent O$_2$, ambient air may be used in place of the 90 percent of span calibration gas mixture. Triplicate analyses of the gas mixture (except ambient air) shall be performed within two weeks prior to use using Reference Method 3 of this part.

2.3 Zero Gas. A gas containing less than 100 ppm of carbon dioxide or oxygen.

2.4 Data Recorder. Analog chart recorder or other suitable device with input voltage range compatible with analyzer system output. The resolution of the recorder's data output shall be sufficient to allow completion of the test procedures within this specification.

3. Definitions.

3.1 Continuous Monitoring System. The total equipment required for the determination of carbon dioxide or oxygen in a given source effluent. The system consists of three major subsystems:

3.1.1 Sampling Interface. That portion of the continuous monitoring system that performs one or more of the following operations: delineation, acquisition, transportation, and conditioning of a sample of the source effluent or protection of the analyzer from the hostile aspects of the sample or source environment.

3.1.2 Analyzer. That portion of the continuous monitoring system which senses the pollutant gas and generates a signal output that is a function of the pollutant concentration.

3.1.3 Data Recorder. That portion of the continuous monitoring system that provides a permanent record of the output signal in terms of concentration units.

3.2 Span. The value of oxygen or carbon dioxide concentration at which the continuous monitoring system is set that produces the maximum data display output. For the purposes of this method, the span shall be set no less than 1.5 to 2.5 times the normal carbon dioxide or normal oxygen concentration in the stack gas of the affected facility.

3.3 Midrange. The value of oxygen or carbon dioxide concentration that is representative of the normal conditions in the stack gas of the affected facility at typical operating rates.

3.4 Zero Drift. The change in the continuous monitoring system output over a stated period of time of normal continuous operation when the carbon dioxide or oxygen concentration at the time for the measurements is zero.

3.5 Calibration Drift. The change in the continuous monitoring system output over a stated time period of normal continuous operation when the carbon dioxide or oxygen continuous monitoring system is measuring the concentration of span gas.

3.6 Operational Test Period. A minimum period of time over which the continuous monitoring system is expected to operate within certain performance specifications without unscheduled maintenance, repair, or adjustment.

3.7 Response time. The time interval from a step change in concentration at the input to the continuous monitoring system to the time at which 95 percent of the corresponding final value is displayed on the continuous monitoring system data recorder.

4. Installation Specification.

Oxygen or carbon dioxide continuous monitoring systems shall be installed at a location where measurements are directly representative of the total effluent from the affected facility or representative of the same effluent sampled by a SO$_2$ or NO$_x$ continuous monitoring system. This requirement shall be complied with by use of applicable requirements in Performance Specification 2 of this appendix as follows:

4.1 Installation of Oxygen or Carbon Dioxide Continuous Monitoring Systems Not Used to Convert Pollutant Data. A sampling location shall be selected in accordance with the procedures under paragraphs 4.2.1 or 4.2.2, or Performance Specification 2 of this appendix.

4.2 Installation of Oxygen or Carbon Dioxide Continuous Monitoring Systems Used to Convert Pollutant Continuous Monitoring System Data to Units of Applicable Standards. The diluent continuous monitoring system (oxygen or carbon dioxide) shall be installed at a sampling location where measurements that can be made are representative of the effluent gases sampled by the pollutant continuous monitoring system(s). Conformance with this requirement may be accomplished in any of the following ways:

4.2.1 The sampling location for the diluent system shall be near the sampling location for the pollutant continuous monitoring system such that the same approximate point(s) (extractive systems) or path (in-situ systems) in the cross section is sampled or viewed.

4.2.2 The diluent and pollutant continuous monitoring systems may be installed at different locations if the effluent gases at both sampling locations are nonstratified as determined under paragraphs 4.1 or 4.3, Performance Specification 2 of this appendix and there is no in-leakage occurring between the two sampling locations. If the effluent gases are stratified at either location, the procedures under paragraph 4.2.2, Performance Specification 2 of this appendix shall be used for installing continuous monitoring systems at that location.

5. Continuous Monitoring System Performance Specifications.

The continuous monitoring system shall meet the performance specifications in Table 3-1 to be considered acceptable under this method.

6. Performance Specification Test Procedures.

The following test procedures shall be used to determine conformance with the requirements of paragraph 4. Due to the wide variation existing in analyzer designs and principles of operation, these procedures are not applicable to all analyzers. Where this occurs, alternative procedures, subject to the approval of the Administrator, may be employed. Any such alternative procedures must fulfill the same purposes (verify response, drift, and accuracy) as the following procedures, and must clearly demonstrate conformance with specifications in Table 3-1.

6.1 Calibration Check. Establish a calibration curve for the continuous monitoring system using zero, midrange, and span concentration gas mixtures. Verify that the resultant curve of analyzer reading compared with the calibration gas value is consistent with the expected response curve as described by the analyzer manufacturer. If the expected response curve is not produced, additional calibration gas measurements shall be made, or additional steps undertaken to verify the accuracy of the response curve of the analyzer.

6.2 Field Test for Zero Drift and Calibration Drift. Install and operate the continuous monitoring system in accordance with the manufacturer's written instructions and drawings as follows:

TABLE 3-1.—*Performance specifications*

Parameter	*Specification*
1. Zero drift (2 h) [1]	$\leq$0.4 pct O_2 or CO_2.
2. Zero drift (24 h) [1]	$\leq$0.5 pct O_2 or CO_2.
3. Calibration drift (2 h) [1]	$\leq$0.4 pct O_2 or CO_2.
4. Calibration drift (24 h) [1]	$\leq$0.5 pct O_2 or CO_2.
5. Operational period	168 h minimum.
6. Response time	10 min.

[1] Expressed as sum of absolute mean value plus 95 pct confidence interval of a series of tests.

6.2.1 Conditioning Period. Offset the zero setting at least 10 percent of span so that negative zero drift may be quantified. Operate the continuous monitoring system for an initial 168-hour conditioning period in a normal operational manner.

6.2.2. Operational Test Period. Operate the continuous monitoring system for an additional 168-hour period maintaining the zero offset. The system shall monitor the source effluent at all times except when being zeroed, calibrated, or backpurged.

6.2.3 Field Test for Zero Drift and Calibration Drift. Determine the values given by zero and midrange gas concentrations at two-hour intervals until 18 sets of data are obtained. For non-extractive continuous monitoring systems, determine the zero value given by a mechanically produced zero condition or by computing the zero value from upscale measurements using calibrated gas cells certified by the manufacturer. The midrange checks shall be performed by using certified calibration gas cells functionally equivalent to less than 50 percent of span. Record these readings on the example sheet shown in Figure 3-1. These two-hour periods need not be consecutive but may not overlap. In-situ CO_2 or O_2 analyzers which cannot be fitted with a calibration gas cell may be calibrated by alternative procedures acceptable to the Administrator. Zero and calibration corrections and adjustments are allowed only at 24-hour intervals or at such shorter intervals as the manufacturer's written instructions specify. Automatic corrections made by the continuous monitoring system without operator intervention or initiation are allowable at any time. During the entire 168-hour test period, record the values given by zero and span gas concentrations before and after adjustment at 24-hour intervals in the example sheet shown in Figure 3-2.

6.3 Field Test for Response Time.

6.3.1 Scope of Test.

This test shall be accomplished using the continuous monitoring system as installed, including sample transport lines if used. Flow rates, line diameters, pumping rates, pressures (do not allow the pressurized calibration gas to change the normal operating pressure in the sample line), etc., shall be at the nominal values for normal operation as specified in the manufacturer's written instructions. If the analyzer is used to sample more than one source (stack), this test shall be repeated for each sampling point.

6.3.2 Response Time Test Procedure.

Introduce zero gas into the continuous monitoring system sampling interface or as close to the sampling interface as possible. When the system output reading has stabilized, switch quickly to a known concentration of gas at 90 percent of span. Record the time from concentration switching to 95 percent of final stable response. After the system response has stabilized at the upper level, switch quickly to a zero gas. Record the time from concentration switching to 95 percent of final stable response. Alternatively, for nonextractive continuous monitoring systems, the highest available calibration gas concentration shall be switched into and out of the sample path and response times recorded. Perform this test sequence three (3) times. For each test, record the results on the data sheet shown in Figure 3-3.

7. Calculations, Data Analysis, and Reporting.

7.1 Procedure for determination of mean values and confidence intervals.

7.1.1 The mean value of a data set is calculated according to equation 3-1.

$$\bar{x}=\frac{1}{n}\sum_{i=1}^{n}x_i \qquad \text{Equation 3-1}$$

where:

x_i=absolute value of the measurements,
Σ=sum of the individual values,
x=mean value, and
n=number of data points.

7.2.1 The 95 percent confidence interval (two-sided) is calculated according to equation 3-2:

$$C.I._{95}=\frac{t_{.975}}{n\sqrt{n-1}}\sqrt{n(\sum x_i^2)-(\sum x_i)^2} \qquad \text{Equation 3-2}$$

where:

ΣX=sum of all data points,
$t_{.975}=t_1-\alpha/2$, and
$C.I._{95}$=95 percent confidence interval estimated of the average mean value. value.

Values for $t_{.975}$

n	$t_{.975}$
2	12.706
3	4.303
4	3.182
5	2.776
6	2.571
7	2.447
8	2.365
9	2.306
10	2.262
11	2.228
12	2.201
13	2.179
14	2.160
15	2.145
16	2.131

The values in this table are already corrected for n-1 degrees of freedom. Use n equal to the number of samples as data points.

7.2 Data Analysis and Reporting.

7.2.1 Zero Drift (2-hour). Using the zero concentration values measured each two hours during the field test, calculate the differences between the consecutive two-hour readings expressed in ppm. Calculate the mean difference and the confidence interval using equations 3-1 and 3-2. Record the sum of the absolute mean value and the confidence interval on the data sheet shown in Figure 3-1.

7.2.2 Zero Drift (24-hour). Using the zero concentration values measured every 24 hours during the field test, calculate the differences between the zero point after zero adjustment and the zero value 24 hours later just prior to zero adjustment. Calculate the mean value of these points and the confidence interval using equations 3-1 and 3-2. Record the zero drift (the sum of the absolute mean and confidence interval) on the data sheet shown in Figure 3-2.

7.2.3 Calibration Drift (2-hour). Using the calibration values obtained at two-hour intervals during the field test, calculate the differences between consecutive two-hour readings expressed as ppm. These values should be corrected for the corresponding zero drift during that two-hour period. Calculate the mean and confidence interval of these corrected difference values using equations 3-1 and 3-2. Do not use the differences between non-consecutive readings. Record the sum of the absolute mean and confidence interval upon the data sheet shown in Figure 3-1.

7.2.4 Calibration Drift (24-hour). Using the calibration values measured every 24 hours during the field test, calculate the differences between the calibration concentration reading after zero and calibration adjustment and the calibration concentration reading 24 hours later after zero adjustment but before calibration adjustment. Calculate the mean value of these differences and the confidence interval using equations 3-1 and 3-2. Record the sum of the absolute mean and confidence interval on the data sheet shown in Figure 3-2.

7.2.5 Operational Test Period. During the 168-hour performance and operational test period, the continuous monitoring system shall not receive any corrective maintenance, repair, replacement, or adjustment other than that clearly specified as required in the manufacturer's written operation and maintenance manuals as routine and expected during a one-week period. If the continuous monitoring system operates within the specified performance parameters and does not require corrective maintenance, repair, replacement or adjustment other than as specified above during the 168-hour test period, the operational period will be successfully concluded. Failure of the continuous monitoring system to meet this requirement shall call for a repetition of the 168 hour test period. Portions of the test which were satisfactorily completed need not be repeated. Failure to meet any performance specifications shall call for a repetition of the one-week performance test period and that portion of the testing which is related to the failed specification. All maintenance and adjustments required shall be recorded. Output readings shall be recorded before and after all adjustments.

7.2.6 Response Time. Using the data developed under paragraph 6.3, calculate the time interval from concentration switching to 95 percent to the final stable value for all upscale and downscale tests. Report the mean of the three upscale test times and the mean of the three downscale test times. The two average times should not differ by more than 15 percent of the slower time. Report the slower time as the system response time. Record the results on Figure 3-3.

8. References.

8.1 "Performance Specifications for Stationary Source Monitoring Systems for Gases and Visible Emissions," Environmental Protection Agency, Research Triangle Park, N.C., EPA-650/2-74-013, January 1974.

8.2 "Experimental Statistics," Department of Commerce, National Bureau of Standards Handbook 91, 1963, pp. 3-31, paragraphs 3-3.1.4.

(Secs. 111 and 114 of the Clean Air Act, as amended by sec. 4(a) of Pub. L. 91-604, 84 Stat. 1678 (42 U.S.C. 1857c-6, by sec. 15(c)(2) of Pub. L. 91-604, 85 Stat. 1713 (42 U.S.C. 1857g)).

Data Set No.	Time		Date	Zero Reading	Zero Drift (ΔZero)	Span Reading	Span Drift (ΔSpan)	Calibration Drift (ΔSpan-ΔZero)
	Begin	End						
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								

Zero Drift = [Mean Zero Drift* ______ + CI (Zero) ______] = ______.
Calibration Drift = [Mean Span Drift* ______ + CI (Span ______] = ______.
*Absolute Value.

Figure 3-1. Zero and Calibration Drift (2 Hour).

Date and Time	Zero Reading	Zero Drift (ΔZero)	Span Reading (After zero adjustment)	Calibration Drift (ΔSpan)

Zero Drift = [Mean Zero Drift* ______ + C.I. (Zero) ______]

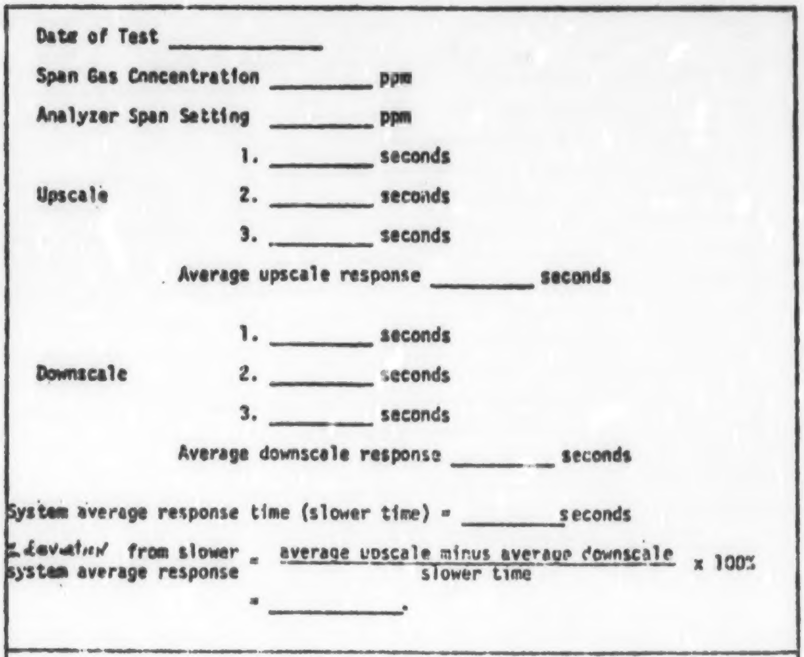
= ______.

Calibration Drift = [Mean Span Drift* ______ + C.I. (Span) ______]

= ______.

* Absolute value

Figure 3-2. Zero and Calibration Drift (24-hour)



Date of Test ____________

Span Gas Concentration ________ ppm

Analyzer Span Setting ________ ppm

Upscale
1. ________ seconds
2. ________ seconds
3. ________ seconds

Average upscale response ________ seconds

Downscale
1. ________ seconds
2. ________ seconds
3. ________ seconds

Average downscale response ________ seconds

System average response time (slower time) = ________ seconds

% deviation from slower system average response = $\frac{\text{average upscale minus average downscale}}{\text{slower time}} \times 100\%$

= ____________.

Figure 3-3. Response

[FR Doc.75-26565 Filed 10-3-75;8:45 am]

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19 Title 40—Protection of Environment

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

SUBCHAPTER C—AIR PROGRAMS

[FRL 442-3]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCE

Delegation of Authority to State of New York

Pursuant to the delegation of authority for the standards of performance for new stationary sources (NSPS) to the State of New York on August 6, 1975, EPA is today amending 40 CFR 60.4, Address, to reflect this delegation. A Notice announcing this delegation is published elsewhere in today's FEDERAL REGISTER. The amended § 60.4, which adds the address of the New York State Department of Environmental Conservation, to which reports, requests, applications, submittals, and communications to the Administrator pursuant to this part must also be addressed, is set forth below.

The Administrator finds good cause for foregoing prior public notice and for making this rulemaking effective immediately in that it is an administrative change and not one of substantive content. No additional substantive burdens are imposed on the parties affected. The delegation which is reflected by this administrative amendment was effective on August 6, 1975, and it serves no purpose to delay the technical change of this addition of the State address to the Code of Federal Regulations. This rulemaking is effective immediately, and is issued under the authority of Section 111 of the Clean Air Act, as amended. 42 U.S.C. 1857c-6.

Dated: October 4, 1975.

STANLEY W. LEGRO,
Assistant Administrator for Enforcement.

Part 60 of Chapter I, Title 40 of the Code of Federal Regulations is amended as follows:

1. In § 60.4 paragraph (b) is amended by revising subparagraph (HH) to read as follows:

§ 60.4 Address.

* * * * *

(b) * * *

(HH)—New York: New York State Department of Environmental Conservation, 50 Wolf Road, New York 12233, attention: Division of Air Resources.

[FR Doc.75-27582 Filed 10-14-75;8:45 am]

FEDERAL REGISTER, VOL. 40, NO. 200—WEDNESDAY, OCTOBER 15, 1975

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20 [449-4]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCE

Delegation of Authority to State of Colorado

Pursuant to the delegation of authority for the standards of performance for eleven categories of new stationary sources (NSPS) to the State of Colorado on August 27, 1975, EPA is today amending 40 CFR 60.4, Address, to reflect this delegation. A Notice announcing this delegation is published today in the FEDERAL REGISTER. The amended § 60.4, which adds the address of the Colorado Air Pollution Control Division to which all reports, requests, applications, submittals, and communications to the Administrator pursuant to this part must also be addressed, is set forth below.

The Administrator finds good cause for foregoing prior public notice and for making this rulemaking effective immediately in that it is an administrative change and not one of substantive content. No additional substantive burdens are imposed on the parties affected. The delegation which is reflected by this administrative amendment was effective on August 27, 1975, and it serves no purpose to delay the technical change of this addition of the State address to the Code of Federal Regulations.

This rulemaking is effective immediately, and is issued under the authority of Section 111 of the Clean Air Act, as amended, 42 U.S.C. 1857c-6.

Dated: October 22, 1975.

STANLEY W. LEGRO,
Assistant Administrator for Enforcement.

Part 60 of Chapter I, Title 40 of the Code of Federal Regulations is amended as follows:

1. In § 60.4 paragraph (b) is amended by revising subparagraph (G) to read as follows:

§ 60.4 Address.

* * * * *

(b) * * *

(G)—State of Colorado, Colorado Air Pollution Control Division, 4210 East 11th Avenue, Denver, Colorado 80220.

* * * * *

[FR Doc.75-29234 Filed 10-30-75;8:45 am]

FEDERAL REGISTER, VOL. 40, NO. 211—FRIDAY, OCTOBER 31, 1975

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Title 40—Protection of Environment

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

SUBCHAPTER C—AIR PROGRAMS

[FRL 437-4]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

State Plans for the Control of Certain Pollutants From Existing Facilities

On October 7, 1974 (39 FR 36102), EPA proposed to add a new Subpart B to Part 60 to establish procedures and requirements for submittal of State plans for control of certain pollutants from existing facilities under section 111(d) of the Clean Air Act, as amended (42 U.S.C. 1857c-6(d)). Interested persons participated in the rulemaking by sending comments to EPA. A total of 45 comment letters was received, 19 of which came from industry, 16 from State and local agencies, 5 from Federal agencies, and 5 from other interested parties. All comments have been carefully considered, and the proposed regulations have been reassessed. A number of changes suggested in comments have been made, as well as changes developed within the Agency.

One significant change, discussed more fully below, is that different procedures and criteria will apply to submittal and approval of State plans where the Administrator determines that a particular pollutant may cause or contribute to the endangerment of public welfare, but that adverse effects on public health have not been demonstrated. Such a determination might be made, for example, in the case of a pollutant that damages crops but has no known adverse effect on public health. This change is intended to allow States more flexibility in establishing plans for the control of such pollutants than is provided for plans involving pollutants that may affect public health.

Most other changes were of a relatively minor nature and, aside from the change just mentioned, the basic concept of the regulations is unchanged. A number of provisions have been reworded to resolve ambiguities or otherwise clarify their meaning, and some were combined or otherwise reorganized to clarify and simplify the overall organization of Subpart B.

BACKGROUND

When Congress enacted the Clean Air Amendments of 1970, it addressed three general categories of pollutants emitted from stationary sources. See Senate Report No. 91-1196, 91st Cong., 2d Sess. 18-19 (1970). The first category consists of pollutants (often referred to as "criteria pollutants") for which air quality criteria and national ambient air quality standards are established under sections 108 and 109 of the Act. Under the 1970 amendments, criteria pollutants are controlled by State implementation plans (SIP's) approved or promulgated under section 110 and, in some cases, by standards of performance for new sources established under section 111. The second category consists of pollutants listed as hazardous pollutants under section 112 and controlled under that section.

The third category consists of pollutants that are (or may be) harmful to public health or welfare but are not or cannot be controlled under sections 108-110 or 112. Section 111(d) requires control of existing sources of such pollutants whenever standards of performance (for those pollutants) are established under section 111(b) for new sources of the same type.

In determining which statutory approach is appropriate for regulation of a particular pollutant, EPA considers the nature and severity of the pollutant's effects on public health or welfare, the number and nature of its sources, and similar factors prescribed by the Act. Where a choice of approaches is presented, the regulatory advantages and disadvantages of the various options are also considered. As indicated above, section 111(d) requires control of existing sources of a pollutant if a standard of performance is established for new sources under section 111(b) and the pollutant is not controlled under sections 108-110 or 112. In general, this means that control under section 111(d) is appropriate when the pollutant may cause or contribute to endangerment of public health or welfare but is not known to be "hazardous" within the meaning of section 112 and is not controlled under sections 108-110 because, for example, it is not emitted from "numerous or diverse" sources as required by section 108.

For ease of reference, pollutants to which section 111(d) applies as a result of the establishment of standards of performance for new sources are defined in § 60.21(a) of the new Subpart B as "designated pollutants." Existing facilities which emit designated pollutants and which would be subject to the standards of performance for those pollutants, if new, are defined in § 60.21(b) as "designated facilities."

As indicated previously, the proposed regulations have been revised to allow States more flexibility in establishing plans where the Administrator determines that a designated pollutant may cause or contribute to endangerment of public welfare, but that adverse effects on public health have not been demonstrated. For convenience of discussion, designated pollutants for which the Administrator makes such a determination are referred to in this preamble as "welfare-related pollutants" (i.e., those requiring control solely because of their effects on public welfare). All other designated pollutants are referred to as "health-related pollutants."

To date, standards of performance have been established under section 111 of the Act for two designated pollutants—fluorides emitted from five categories of sources in the phosphate fertilizer industry (40 FR 33152, August 6, 1975) and sulfuric acid mist emitted from sulfuric acid production units (36 FR 24877, December 23, 1971). In addition, standards of performance have been proposed for fluorides emitted from primary aluminum plants (39 FR 37730, October 23, 1974), and final action on these standards will occur shortly. EPA will publish draft guideline documents (see next section) for these pollutants in the near future. Although a final decision has not been made, it is expected that sulfuric acid mist will be determined to be a health-related pollutant and that fluorides will be determined to be welfare-related.

SUMMARY OF REGULATIONS

Subpart B provides that after a standard of performance applicable to emissions of a designated pollutant from new sources is promulgated, the Administrator will publish guideline documents containing information pertinent to control of the same pollutant from designated (i.e., existing) facilities [§ 60.22(a)]. The guideline documents will include "emission guidelines" (discussed below) and compliance times based on factors specified in § 60.22(b)(5) and will be made available for public comment in draft form before being published in final form. For health-related pollutants, the Administrator will concurrently propose and subsequently promulgate the emission guidelines and compliance times referred to above [§ 60.22(c)]. For welfare-related pollutants, emission guidelines and compliance times will appear only in the applicable guideline documents [§ 60.22(d)(1)].

The Administrator's determination that a designated pollutant is heath-related, welfare-related, or both and the rationale for the determination will be provided in the draft guideline document for that pollutant. In making this determination, the Administrator will consider such factors as: (1) Known and suspected effects of the pollutant on public health and welfare; (2) potential ambient concentrations of the pollutant; (3) generation of any secondary pollutants for which the designated pollutant may be a precursor; (4) any synergistic effect with other pollutants; and (5) potential effects from accumulation in the environment (e.g., soil, water and food chains). After consideration of comments and other information a final determination and rationale will be published in the final guidelines document.

For both health-related and welfare-related pollutants, emission guidelines will reflect the degree of control attainable with the application of the best systems of emission reduction which (considering the cost of such reduction) have been adequately demonstrated for designated facilities [§ 60.21(e)]. As discussed more fully below, the degree of control reflected in EPA's emission guidelines will take into account the costs of retrofitting existing facilities and thus will probably be less stringent than corresponding standards of performance for new sources.

After publication of a final guideline document for a designated pollutant, the States will have nine months to develop and submit plans containing emission standards for control of that pollutant from designated facilities [§ 60.23(a)]. For health-related pollutants, State emission standards must ordinarily be at least as stringent as the corresponding EPA guidelines to be approvable [§ 60.24(c)]. However, States may apply less stringent standards to particular sources (or classes of sources) when economic factors or physical limitations specific to particular sources (or classes of sources) make such application significantly more reasonable [§ 60.24(f)]. For welfare-related pollutants, States may balance the emission guidelines and other information provided in EPA's guideline documents against other factors of public concern in establishing their emission standards, provided that appropriate consideration is given to the information presented in the guideline documents and at public hearings and that other requirements of Subpart B are met [§ 60.24(d)].

Within four months after the date required for submission of a plan, the Administrator will approve or disapprove the plan or portions thereof [§ 60.27(b)]. If a State plan (or portion thereof) is disapproved, the Administrator will promulgate a plan (or portion thereof) within 6 months after the date required for plan submission [§ 60.27(d)]. The plan submittal, approval/disapproval, and promulgation procedures are basically patterned after section 110 of the Act and 40 CFR Part 51 (concerning adoption and submittal of State implementation plans under section 110).

For health-related pollutants, the emission guidelines and compliance times referred to above will appear in a new Subpart C of Part 60. As indicated previously, emission guidelines and compliance times for welfare-related pollutants will appear only in the guideline documents published under § 60.22(a). Approvals and disapprovals of State plans and any plans (or portions thereof) promulgated by the Administrator will appear in a new Part 62.

COMMENTS RECEIVED ON PROPOSED REGULATIONS AND CHANGES MADE IN FINAL REGULATIONS

Many of the comment letters received by EPA contained multiple comments. The most significant comments and differences between the proposed and final regulations are discussed below. Copies of the comment letters and a summary of the comments with EPA's responses (entitled "Public Comment Summary: Section 111(d) Regulations") are available for public inspection and copying at the EPA Public Information Reference Unit, Room 2922 (EPA Library), 401 M Street, SW., Washington, D.C. 20460. In addition, copies of the comment summary may be obtained upon written request from the EPA Public Information Center (PM-215), 401 M Street, SW., Washington, D.C. 20460 (specify "Public Comment Summary: Section 111(d) Regulations").

(1) *Definitions and basic concepts.* The term "emission limitation" as defined in proposed § 60.21(e) has apparently caused some confusion. As used in the proposal, the term was not intended to mean a legally enforceable national emission standard as some comments suggested. Indeed, the term was chosen in an attempt to avoid such confusion. EPA's rationale for using the emission limitation concept is presented below in the discussion of the basis for approval or disapproval of State plans. However, to emphasize that a legally enforceable standard is not intended, the term "emission limitation" has been replaced with the term "emission guideline" [see § 60.21(e)]. In addition, proposed § 60.27 (concerning publication of guideline documents and so forth) has been moved forward in the regulations (becoming § 60.22) to emphasize that publication of a final guideline document is the "trigger" for State action under subsequent sections of Subpart B [see § 60.23(a)].

Many commentators apparently confused the degree of control to be reflected in EPA's emission guidelines under section 111(d) with that to be required by corresponding standards of performance for new sources under section 111(b). Although the general principle (application of best adequately demonstrated control technology, considering costs) will be the same in both cases, the degrees of control represented by EPA's emission guidelines will ordinarily be less stringent than those required by standards of performance for new sources because the costs of controlling existing facilities will ordinarily be greater than those for control of new sources. In addition, the regulations have been amended to make clear that the Administrator will specify different emission guidelines for different sizes, types, and classes of designated facilities when costs of control, physical limitations, geographical location, and similar factors make subcategorization appropriate [§ 60.22(b)(5)]. Thus, while there may be only one standard of performance for new sources of designated pollutants, there may be several emission guidelines specified for designated facilities based on plant configuration, size, and other factors peculiar to existing facilities.

Some comments evidenced confusion regarding the relationship of affected facilities and designated facilities. An affected facility, as defined in § 60.2(e), is a new or modified facility subject to a standard of performance for new stationary sources. An existing facility [§ 60.2(aa)] is a facility of the same type as an affected facility, but one the construction of which commenced before the date of proposal of applicable standards of performance. A designated facility [§ 60.21(d)] is an existing facility which emits a designated pollutant.

A few industry comments argued that the proposed regulations would permit EPA to circumvent the legal and technical safeguards required under sections 108, 109, and 110 of the Act, sections which the commentators characterized as the basic statutory process for control of existing facilities. Congress clearly intended control of existing facilities under sections other than 108, 109, and 110. Sections 112 and 303 as well as 111(d) itself provide for control of existing facilities. Moreover, action under section 111(d) is subject to a number of significant safeguards: (1) Before acting under section 111(d) the Administrator must have found under section 111(b) that a source category may significantly contribute to air pollution which causes or contributes to the endangerment of public health or welfare, and this finding must be technically supportable; (2) EPA's emission guidelines will be developed in consultation with industrial groups and the National Air Pollution Control Techniques Advisory Committee, and they will be subject to public comment before they are adopted; (3) emission standards and other plan provisions must be subjected to public hearings prior to adoption; (4) relief is available under § 60.24(f) or § 60.27(e)(2) where application of emission standards to particular sources would be unreasonable; and (5) judicial review of the Administrator's action in approving or promulgating plans (or portions thereof) is available under section 307 of the Act.

A number of commentators suggested that special provisions for plans submitted under section 111(d) are unnecessary since existing facilities are covered by State implementation plans (SIPs) approved or promulgated under section 110 of the Act. By its own terms, however, section 111(d) requires the Administrator to prescribe regulations for section 111(d) plans. In addition, the pollutants to which section 111(d) applies (i.e., designated pollutants) are not controlled as such under the SIPs. Under section 110, the SIPs only regulate criteria pollutants; i.e., those for which national ambient air quality standards have been established under section 109 of the Act. By definition, designated pollutants are non-criteria pollutants [§ 60.21(a)]. Although some designated pollutants may occur in particulate as well as gaseous forms and thus may be controlled to some degree under SIP provisions requiring control of particulate matter, specific rather than incidental control of such pollutants is required by section 111(d). For these reasons, separate regulations are necessary to establish the framework for specific control of designated pollutants under section 111(d).

Comments of a similar nature argued that if there are demonstrable health and welfare effects from designated pollutants, either air quality criteria should be established and SIPs submitted under sections 108–110 of the Act, or the provisions of section 112 of the Act should be applied. Section 111(d) of the Act was specifically designed to require control of pollutants which are not presently considered "hazardous" within the meaning of section 112 and for which ambient air quality standards have not been promulgated. Health and welfare effects from these designated pollutants often cannot be quantified or are of such a nature that the effects are cumulative and not associated with any particular ambient level. Quite often, health and welfare problems caused by such pollutants are highly localized and thus an extensive procedure, such as the SIPs require, is not justified. As previously indicated, Congress specifically recognized the need for control of a third category of pollutants; it also recognized that as additional information becomes available, these pollutants might later be reclassified as hazardous or criteria pollutants.

Other commentators reasoned that since designated pollutants are defined as non-criteria and non-hazardous pollutants, only harmless substances would fall within this category. These commentators argued that the Administrator should establish that a pollutant has adverse effects on public health or welfare before it could be regulated under section 111(d). Before acting under section 111(d), however, the Administrator must establish a standard of performance under section 111(b). In so doing, the Administrator must find under section 111(b) that the source category covered by such standards may contribute significantly to air pollution which causes or contributes to the endangerment of public health or welfare.

(2) *Basis for approval or disapproval of State plans*. A number of industry comments questioned EPA's authority to require, as a basis for approval of State plans, that the States establish emission standards that (except in cases of economic hardship) are equivalent to or more stringent than EPA's emission guidelines. In general, these comments argued that EPA has authority only to prescribe procedural requirements for adoption and submittal of State plans, leaving the States free to establish emission standards on any basis they deem necessary or appropriate. Most State comments expressed no objection to EPA's interpretation on this point, and a few explicitly endorsed it.

After careful consideration of these comments, EPA continues to believe, for reasons summarized below, that its interpretation of section 111(d) is legally correct. Moreover, EPA believes that its interpretation is essential to the effective implementation of section 111(d), particularly where health-related pollutants are involved. As discussed more fully below, however, EPA has decided that it is appropriate to allow States somewhat more flexibility in establishing plans for the control of welfare-related pollutants and has revised the proposed regulations accordingly.

Although section 111(d) does not specify explicit criteria for approval or disapproval of State plans, the Administrator must disapprove plans that are not "satisfactory" [Section 111(d)(2)(A)]. Appropriate criteria must therefore be inferred from the language and context of section 111(d) and from its legislative history. It seems clear, for example, that the Administrator must disapprove plans not adopted and submitted in accordance with the procedural requirements he prescribes under section 111(d), and none of the commentators questioned this concept. The principal questions, therefore, are whether Congress intended that the Administrator base approvals and disapprovals on substantive as well as procedural criteria and, if so, on what types of substantive criteria.

A brief summary of the legislative history of section 111(d) will facilitate discussion of these questions. Section 111(d) was enacted as part of the Clean Air Amendments of 1970. No comparable provision appeared in the House bill. The Senate bill, however, contained a section 114 that would have required the establishment of national emission standards for "selected air pollution agents." Although the term "selected air pollution agent" did not include pollutants that might affect public welfare [which are subject to control under section 111(d)], its definition otherwise corresponded to the description of pollutants to be controlled under section 111(d). Section 114 of the Senate bill was rewritten in conference to become section 111(d). Although the Senate report and debates include references to the intent of section 114, neither the conference report nor subsequent debates include any discussion of section 111(d) as finally enacted. In the absence of such discussion, EPA believes inferences concerning the legislative intent of section 111(d) may be drawn from the general purpose of section 114 of the Senate bill and from the manner in which it was rewritten in conference.

After a careful examination of section 111(d), its statutory context, and its legislative history, EPA believes the following conclusions may be drawn:

(1) As appears from the Senate report and debates, section 114 of the Senate bill was designed to address a specific problem. That problem was how to reduce emissions of pollutants which are (or may be) harmful to health but which, on the basis of information likely to be available in the near term, cannot be controlled under other sections of the Act as criteria pollutants or as hazardous pollutants. (It was made clear that such pollutants might be controlled as criteria or hazardous pollutants as more definitive information became available.) The approach taken in section 114 of the Senate bill was to require national emission standards designed to assure that emissions of such pollutants would not endanger health.

(2) The Committee of Conference chose to rewrite the Senate provision as part of section 111, which in effect requires maximum feasible control of pollutants from new stationary sources through technology-based standards (as opposed to standards designed to assure protection of health or welfare or both). For reasons summarized below, EPA believes this choice reflected a decision in conference that a similar approach (making allowances for the costs of controlling existing sources) was appropriate for the pollutants to be controlled under section 111(d).

(3) As reflected in the Senate report and debates, the pollutants to be controlled under section 114 of the Senate bill were considered a category distinct from the pollutants for which criteria documents had been written or might soon be written. In part, these pollutants differed from the criteria pollutants in that much less information was available concerning their effects on public health and welfare. For that reason, it would have been difficult—if not impossible—to prescribe legally defensible standards designed to protect public health or welfare for these pollutants until more definitive information became available. Yet the pollutants, by definition, were those which (although not criteria pollutants and not known to be hazardous) had or might be expected to have adverse effects on health.

(4) Under the circumstances, EPA believes, the conferees decided (a) that control of such pollutants on some basis was necessary; (b) that, given the relative lack of information on their health and welfare effects, a technology-based approach (similar to that for new sources) would be more feasible than one involving an attempt to set standards tied specifically to protection of health; and (c) that the technology-based approach (making allowances for the costs of controlling existing sources) was a reasonable means of attacking the problem until more definitive information became known, particularly because the States would be free under section 116 of the Act to adopt more stringent standardse if they believed additional control was desirable. In short, EPA believes the conferees chose to rewrite section 114 as part of section 111 largely because they intended the technology-based approach of that section to extend (making allowances for the costs of controlling existing sources) to action under section 111(d). In this view, it was unnecessary (although it might have been desirable) to specify explicit substantive criteria in section 111(d) because the intent to require a technology-based approach could be inferred from placement of the provision in section 111.

Related considerations support this interpretation of section 111(d). For example, section 111(d) requires the Administrator to prescribe a plan for a State that fails to submit a satisfactory plan. It is obvious that he could only prescribe standards on some substantive basis. The references to section 110 of the Act suggest that (as in section 110) he was intended to do generally what the States in such cases should have done, which in turn suggests that (as in section 110) Congress intended the States to prescribe standards on some substantive basis. Thus, it seems clear that some substantive criterion was intended to govern not only the Administrator's promulgation of standards but also his review of State plans.

Still other considerations support EPA's interpretation of section 111(d). Even a cursory examination of the legislative history of the 1970 amendments reveals that Congress was dissatisfied with air pollution control efforts at all levels of government and was convinced that relatively drastic measures were necessary to protect public health and welfare. The result was a series of far-reaching amendments which, coupled with virtually unprecedented statutory deadlines, required EPA and the States to take swift and aggressive action. Although Congress left initial responsibility with the States for control of criteria pollutants under section 110, it set tough minimum criteria for such action and required Federal assumption of responsibility where State action was inadequate. It also required direct Federal action for control of new stationary sources, hazardous pollutants, and mobile sources. Finally, in an extraordinary departure from its practice of delegating rulemaking authority to administrative agencies (a departure intented to force the pace of pollution control efforts in the automobile industry), Congress itself enacted what amounted to statutory emission standards for the principal automotive pollutants.

Against this background of Congressional firmness, the overriding purpose of which was to protect public health and welfare, it would make no sense to interpret section 111(d) as requiring the Administrator to base approval or disapproval of State plans solely on procedural criteria. Under that interpretation, States could set extremely lenient standards—even standards permitting greatly increased emissions—so long as EPA's procedural requirements were met. Given that the pollutants in question are (or may be) harmful to public health and welfare, and that section 111(d) is the only provision of the Act requiring their control, it is difficult to believe that Congress meant to leave such a gaping loophole in a statutory scheme otherwise designed to force meaningful action.

Some of the comments on the proposed regulations assume that the States were intended to set emission standards based directly on protection of public health and welfare. EPA believes this view is consistent with its own view that the Administrator was intended to base approval or disapproval of State plans on substantive as well as procedural criteria but believes Congress intended a technology-based approach rather than one based directly on protection of health and welfare. The principal factors leading EPA to this conclusion are summarized above. Another is that if Congress had intended an approach based directly on protection of health and welfare, it could have rewritten section 114 of the Senate bill as part of section 110, which epitomizes that approach, rather than as part of section 111. Indeed, with relatively minor changes in language, Congress could simply have retained section 114 as a separate section requiring action based directly on protection of health and welfare.

Still another factor is that asking each of the States, many of which had limited resources and expertise in air pollution control, to set standards protective of health and welfare in the absence of adequate information would have made even less sense than requiring the Administrator to do so with the various resources at his command. Requiring a technology-based approach, on the other hand, would not only shift the criteria for decision-making to more solid ground (the availability and costs of control technology) but would also take advantage of the information and expertise available to EPA from its assessment of techniques for the control of the same pollutants from the same types of sources under section 111 (b), as well as its power to compel submission of information about such techniques under section 114 of the Act (42 U.S.C. 1857c-9). Indeed, section 114 was made specifically applicable for the purpose (among others) of assisting in the development of State plans under section 111(d). For all of these reasons, EPA believes Congress intended a technology-based approach rather than one based directly on protection of health and welfare.

Some of the comments argued that EPA's emission guidelines under section 111(d) will, in effect, be national emission standards for existing sources, a concept they argue was rejected in section 111(d). In general, the comments rely on the fact that although section 114 of the Senate bill specifically provided for national emission standards, section 111(d) calls for establishment of emission standards by States. EPA believes that the rewriting of section 114 in conference is consistent with the establishment of national criteria by which to judge the adequacy of State plans, and that the approach taken in section 111(d) may be viewed as largely the result of two decisions: (1) To adopt a technology-based approach similar to that for new sources; and (2) to give States a greater role than was provided in section 114. Thus, States will have primary responsibility for developing and enforcing control plans under section 111(d); under section 114, they would only have been invited to seek a delegation of authority to enforce Federally developed standards. Under EPA's interpretation of section 111(d), States will also have authority to grant variances in cases of economic hardship; under section 114, only the Administrator would have had authority to grant such relief. As with section 110, assigning primary responsibility to the States in these areas is perfectly consistent with review of their plans on some substantive basis. If there is to be substantive review, there must be criteria for the review, and EPA believes it is desirable (if not legally required) that the criteria be made known in advance to the States, to industry, and to the general public. The emission guidelines, each of which will be subjected to public comment before final adoption, will serve this function.

In any event, whether or not Congress "rejected" the concept of national emission standards for existing sources, EPA's emission guidelines will not have the purpose or effect of national emission standards. As emphasized elsewhere in this preamble, they will not be requirements enforceable against any source. Like the national ambient air quality standards prescribed under section 109 and the items set forth in section 110(a)(2)(A)-(H), they will only be criteria for judging the adequacy of State plans.

Moreover, it is inaccurate to argue (as did one comment) that, because EPA's emission guidelines will reflect best available technology considering cost, States will be unable to set more stringent standards. EPA's emission guidelines will reflect its judgment of the degree of control that can be attained by various classes of existing sources without unreasonable costs. Particular sources within a class may be able to achieve greater control without unreasonable costs. Moreover, States that believe additional control is necessary or desirable will be free under section 116 of the Act to require more expensive controls, which might have the effect of closing otherwise marginal facilities, or to ban particular categories of sources outright. Section 60.24(g) has been added to clarify this point. On the other hand, States will be free to set more lenient standards, subject to EPA review, as provided in §§ 60.24(d) and (f) in the case of welfare-related pollutants and in cases of economic hardship.

Finally, as discussed elsewhere in this preamble, EPA's emission guidelines will reflect subcategorization within source categories where appropriate, taking into account differences in sizes and types of facilities and similar con- §§ 60.24 (d) and (f) in the case of wel- siderations, including differences in control costs that may be involved for sources located in different parts of the country. Thus, EPA's emission guidelines will in effect be tailored to what is reasonably achievable by particular classes of existing sources, and States will be free to vary from the levels of control represented by the emission guidelines in the ways mentioned above. In most if not all cases, the result is likely to be substantial variation in the degree of control required for particular sources, rather than identical standards for all sources.

In summary, EPA believes section 111(d) is a hybrid provision, intended to combine primary State responsibility for plan development and enforcement (as in section 110) with the technology-based approach (making allowances for the costs of controlling existing sources) taken in section 111 generally. As indicated above, EPA believes its interpretation of section 111(d) is legally correct in view of the language, statutory context and legislative history of the provision.

Even assuming some other interpretation were permissible, however, EPA believes its interpretation is essential to the effective implementation of section 111(d), particularly where health-related pollutants are involved. Most of the reasons for this conclusion are discussed above, but it may be useful to summarize them here. Given the relative lack of information concerning the effects of designated pollutants on public health and welfare, it would be difficult—if not impossible—for the States or EPA to prescribe legally defensible standards based directly on protection of health and welfare. By contrast, a technology-based approach takes advantage of the information and expertise available to EPA from its assessment of techniques for the control of the same pollutants from the same types of sources under section 111(b), as well as EPA's power to compel submission of information about such techniques under section 114 of the Act. Given the variety of circumstances that may be encountered in controlling existing as opposed to new sources, it makes sense to have the States develop plans based on technical information provided by EPA and make judgments, subject to EPA review, concerning the extent to which less stringent requirements are appropriate. Finally, EPA review of such plans for their substantive adequacy is essential (particularly for health-related pollutants) to assure that meaningful controls will be imposed. For these reasons, given a choice of permissible interpretations of section 111(d), EPA would choose the interpretation on which Subpart B is based on the ground that it is essential to the effective implementation of the provision, particularly where health-related pollutants are involved.

As indicated previously, however, EPA has decided that it is appropriate to allow the States more flexibility in establishing plans for the control of welfare-related pollutants than is provided for plans involving health-related pollutants. Accordingly, the proposed regulations have been revised to provide that States may balance the emission guidelines, compliance times and other information in EPA's guideline documents against other factors in establishing emission standards, compliance schedules, and variances for welfare-related pollutants, provided that appropriate consideration is given to the information presented in the guideline documents and at public hearings, and that all other requirements of Subpart B are met [§ 60.24(d)]. Where sources of pollutants that cause only adverse effects to crops are located in nonagricultural areas, for example, or where residents of a local community depend on an economically marginal plant for their livelihood, such factors could be taken into account. Consistent with section 116 of the Act, of course, States will remain free to adopt requirements as stringent as (or more stringent than) the corresponding emission guidelines and compliance times specified in EPA's guideline documents if they wish [see § 60.24(g)].

A number of factors influenced EPA's decision to allow States more flexibility in establishing plans for control of welfare-related pollutants than is provided for plans involving health-related pollutants. The dominant factor, of course, is that effects on public health would not be expected to occur in such cases, even if State plans required no greater controls than are presently in effect. In a sense, allowing the States greater latitude in such cases simply reflects EPA's view (stated in the preamble to the proposed regulations) that requiring maximum feasible control of designated pollutants may be unreasonable in some situations. Although pollutants that cause only damage to vegetation, for example, are subject to control under section 111(d), few would argue that requiring maximum feasible control is as important for such pollutants as it is for pollutants that endanger public health.

This fundamental distinction—between effects on public health and effects on public welfare—is reflected in section 110 of the Act, which requires attainment of national air quality standards that protect public health within a certain time (regardless of economic and social consequences) but requires attainment of national standards that protect public welfare only within "a reasonable time." The significance of this distinction is reflected in the legislative history of section 110; and the legislative history of section 111(d), although inconclusive, suggests that its primary purpose was to require control of pollutants that endanger public health. For these reasons, EPA believes it is both permissible under section 111(d) and appropriate as a matter of policy to approve State plans requiring less than maximum feasible control of welfare-related pollutants where the States wish to take into account considerations other than technology and cost.

On the other hand, EPA believes section 111(d) requires maximum feasible control of welfare-related pollutants in the absence of such considerations and will disapprove plans that require less stringent control without some reasoned explanation. For similar reasons, EPA will promulgate plans requiring maximum feasible control if States fail to submit satisfactory plans for welfare-related pollutants [§ 60.27(e)(1).] Under § 60.27(e)(2), however, relief will still be available for particular sources where economic hardship can be shown.

(3) *Variances.* One comment asserted that neither the letter nor the intent of section 111 allows variances from plan requirements based on application of best adequately demonstrated control systems. Although section 111(d) does not explicitly provide for variances, it does require consideration of the cost of applying standards to existing facilities. Such a consideration is inherently different than for new sources, because controls cannot be included in the design of an existing facility and because physical limitations may make installation of particular control systems impossible or unreasonably expensive in some cases. For these reasons, EPA believes the provision [§ 60.24(f)] allowing States to grant relief in cases of economic hardship (where health-related pollutants are involved) is permissible under section 111(d). For the same reasons, language has been included in § 60.24(d) to make clear that variances are also permissible where welfare-related pollutants are involved, although the flexibility provided by that provision may make variances unnecessary.

Several commentators urged that proposed § 60.23(e) [now § 60.24(f)] be amended to indicate that States are not required to consider applications for variances if they do not feel it appropriate to do so. The commentators contended that the proposed wording would invite applications for variances, would allow sources to delay compliance by submitting such applications, might conflict with existing State laws, and would probably impose significant burdens on State and local agencies. In addition, there is some question whether the mandatory review provision as proposed would be consistent with section 116 of the Act, which makes clear that States are free to adopt and enforce standards more stringent than Federal standards. Accordingly, the proposed wording has been amended to permit, but not require, State review of facilities for the purpose of applying less stringent standards. To give the States more flexibility, § 60.24(f) has also been amended to permit variances for particular classes of sources as well as for particular sources.

Other comments requested that EPA make clear whether proposed § 60.23(e) [now § 60.24(f)] would allow permanent variances or whether EPA intends ultimate compliance with the emission standards that would apply in the absence of variances. Section 60.24(f) is intended to utilize existing State variance procedures as much as possible. Thus it is up to the States to decide whether less stringent standards are to be applied permanently or whether ultimate compliance will be required.

Another commentator suggested that compliance with or satisfactory progress toward compliance with an existing State emission standard should be a sufficient reason for applying a less stringent standard under § 60.24(f). Such compliance is not necessarily sufficient because existing standards have not always been developed with the intention of requiring maximum feasible control. As indicated in the preamble to the proposed regulations, however, if an existing State emission standard is relatively close to the degree of control that would otherwise be required, and the cost of additional control would be relatively great, there may be justification to apply a less stringent standard under § 60.24(f).

One thoughtful comment suggested that consideration of variances under Subpart B could in effect undermine related SIP requirements; e.g., where designated pollutants occur in particulate forms and are thus controlled to some extent under SIP requirements applicable to particulate matter. Nothing in section 111(d) or Subpart B, however, will preempt SIP requirements. In the event of a conflict, protection of health and welfare under section 110 must control.

(4) *Public hearing requirement.* Based on comments that the requirement for a public hearing on the plan in each AQCR

containing a designated facility is too burdensome, the proposed regulation has been amended to require only one hearing per State per plan. While the Agency advocates public participation in environmental rulemaking, it also recognizes the expense and effort involved in holding multiple hearings. States are urged to hold as many hearings as practicable to assure adequate opportunity for public participation. The hearing requirements have also been amended to provide that a public hearing is not required in those States which have an existing emission standard that was adopted after a public hearing and is at least as stringent as the corresponding EPA emission guidelines, and to permit approval of State notice and hearing procedures different than those specified in Subpart B in some cases.

(5) *Compliance schedules.* The proposed regulation required that all compliance schedules be submitted with the plan. Several commentators suggested that this requirement would not allow sufficient time for negotiation of schedules and could cause duplicative work if the emission standards were not approved. For this reason a new § 60.24(e)(2) has been added to allow submission of compliance schedules after plan submission but no later than the date of the first semiannual report required by § 60.25(e).

(6) *Existing regulations.* Several comments dealt with States which have existing emission standards for designated pollutants. One commentator urged that such States be exempted from the requirements of adopting and submitting plans. However, the Act requires EPA to evaluate both the adequacy of a State's emission standards and the procedural aspects of the plan. Thus, States with existing regulations must submit plans.

Another commentator suggested that the Administrator should approve existing emission standards which, because they are established on a different basis (e.g., concentration standards vs. process-weight-rate type standards), are more stringent than the corresponding EPA emission guideline for some facilities and less stringent for others. The Agency cannot grant blanket approval for such emission standards; however, the Administrator may approve that part of an emission standard which is equal to or more stringent than the EPA emission guideline and disapprove that portion which is less stringent. Also, the less stringent portions may be approvable in some cases under § 60.24 (d) or (f). Finally, subcategorization by size of source under § 60.22(b)(5) will probably limit the number of cases in which this situation will arise.

Other commentators apparently assumed that some regulations for designated pollutants were approved in the State implementation plans (SIPs). Although some States may have submitted regulations limiting emissions of designated pollutants with the SIPs, such regulations were not considered in the approval or disapproval of those plans and are not considered part of approved plans because, under section 110, SIPs, apply only to criteria pollutants.

(7) *Emission inventory data and reports.* Section 60.24 of the proposed regulations [now § 60.25] required emission inventory data to be submitted on data forms which the Administrator was to specify in the future. It was expected that a computerized subsystem to the National Emission Data System (NEDS) would be available that would accommodate emission inventory information on the designated pollutants. However, since this subsystem and concomitant data form will probably not be developed and approved in time for plan development, the designated pollutant information called for will not be required in computerized data format. Instead, the States will be permitted to submit this information in a non-computerized format as outlined in a new Appendix D along with the basic facility information on NEDS forms (OMB #158-R0095) according to procedures in APTD 1135, "Guide for Compiling a Comprehensive Emission Inventory" available from the Air Pollution Technical Information Center, Environmental Protection Agency, Research Triangle Park, North Carolina 27711. In addition, § 60.25(f)(5) has been amended to require submission of additional information with the semiannual reports in order to provide a better tracking mechanism for emission inventory and compliance monitoring purposes.

(8) *Timing.* Proposed § 60.27(a) required proposal of emission guidelines for designated pollutants simultaneously with proposal of corresponding standards of performance for new (affected) facilities. This section, redesignated § 60.22, has been amended to require proposal (or publication for public comment) of an emission guideline after promulgation of the corresponding standard of performance. Two written comments and several informal comments from industrial representatives indicated that more time was needed to evaluate a standard of performance and the corresponding emission guideline than would be allowed by simultaneous proposal and promulgation. Also, by proposing (or publishing) an emission guideline after promulgation of the corresponding standard of performance, the Agency can benefit from the comments on the standard of performance in developing the emission guideline.

Proposed § 60.27(a) required proposal of sulfuric acid mist emission guidelines within 30 days after promulgation of Subpart B. This provision was included as an exception to the proposed general rule (requiring simultaneous proposal of emission guidelines and standards of performance) because it was impossible to propose the acid mist emission guideline simultaneously with the corresponding standard of performance, which had been promulgated previously. The change in the general rule, discussed above, makes the proposed exception unnecessary, so it has been deleted. As previously stated, the Agency intends to establish emission guidelines for sulfuric acid mist [and for fluorides, for which new source standards were promulgated (40 FR 33152) after proposal of Subpart B] as soon as possible.

(9) *Miscellaneous.* Several commentators argued that the nine months provided for development of State plans after promulgation of an emission guideline by EPA would be insufficient. In most cases, much of the work involved in plan development, such as emission inventories, can be begun when an emission guideline is proposed (or published for comment) by EPA; thus, several additional months will be gained. Extensive control strategies are not required, and after the first plan is submitted, submitted, subsequent plans will mainly consist of adopted emission standards. Section 111(d) plans will be much less complex than the SIPs, and Congress provided only nine months for SIP development. Also, States may already have approvable procedures and legal authority [see §§ 60.25(d) and 60.26(b)], and the number of designated facilities per State should be few. For these reasons, the nine-month provision has been retained.

Some comments recommended that the requirements for adoption and submittal of section 111(d) plans appear in 40 CFR Part 51 or in some part of 40 CFR other than Part 60, to allow differentiation among such requirements, emission guidelines, new source standards and plans promulgated by EPA. The Agency believes that the section 111(d) requirements neither warrant a separate part nor should appear in Part 51, since Part 51 concerns control under section 110 of the Act. For clarity, however, subpart B of Part 60 will contain the requirements for adoption and submittal of section 111(d) plans; Subpart C of Part 60 will contain emission guidelines and times for compliance promulgated under § 60.22 (c); and a new Part 62 will be used for approval or disapproval of section 111(d) and for plans (or portions thereof) promulgated by EPA where State plans are disapproved in whole or in part.

Two comments suggested that the plans should specify test methods and procedures to be used in demonstrating compliance with the emission standards. Only when such procedures and methods are known can the stringency of the emission standard be determined. Accordingly, this change has been included in § 60.24(b).

A new § 60.29 has been added to make clear that the Administrator may revise plan provisions he has promulgated under § 60.27(d), and § 60.27(e) has been revised to make clear that he will consider applications for variances from emission standards promulgated by EPA.

Effective Date. These regulations become effective on December 17, 1975.

(Sections 111, 114, and 301 of the Clean Air Act, as amended by sec. 4(a) of Pub. L. 91-604, 84 Stat. 1678, and by sec. 15(c)(2) of Pub. L. 91-604, 84 Stat. 1713 (42 U.S.C. 1857c-6, and 1857c-9, 1857g).

Dated: November 5, 1975.

JOHN QUARLES,
Acting Administrator.

Part 60 of Chapter I, Title 40 of the Code of Federal Regulations is amended as follows:

1. The table of sections for Part 60 is amended by adding a list of sections for Subpart B and by adding Appendix D to the list of appendixes as follows:

* * * * *

Subpart B—Adoption and Submittal of State Plans for Designated Facilities

Sec.
60.20 Applicability.
60.21 Definitions.
60.22 Publication of guideline documents, emission guidelines, and final compliance times.
60.23 Adoption and submittal of State plans; public hearings.
60.24 Emission standards and compliance schedules.
60.25 Emission inventories, source surveillance, reports.
60.26 Legal authority.
60.27 Actions by the Administrator.
60.28 Plan revisions by the State.
60.29 Plan revisions by the Administrator.

* * * * *

APPENDIX D—REQUIRED EMISSION INVENTORY INFORMATION

2. The authority citation at the end of the table of sections for Part 60 is revised to read as follows:

AUTHORITY: Secs. 111 and 114 of the Clean Air Act, as amended by sec. 4(a) of Pub. L. 91-604, 84 Stat. 1678 (42 U.S.C. 1857c-6, 1857c-9). Subpart B also issued under sec. 301(a) of the Clean Air Act, as amended by sec. 15(c)(2) of Pub. L. 91-604, 84 Stat. 1713 (42 U.S.C. 1857g).

3. Section 60.1 is revised to read as follows:

§ 60.1 Applicability.

Except as provided in Subparts B and C, the provisions of this part apply to the owner or operator of any stationary source which contains an affected facility, the construction or modification of which is commenced after the date of publication in this part of any standard (or, if earlier, the date of publication of any proposed standard) applicable to that facility.

4. Part 60 is amended by adding Subpart B as follows:

Subpart B—Adoption and Submittal of State Plans for Designated Facilities

§ 60.20 Applicability.

The provisions of this subpart apply to States upon publication of a final guideline document under § 60.22(a).

§ 60.21 Definitions.

Terms used but not defined in this subpart shall have the meaning given them in the Act and in subpart A:

(a) "Designated pollutant" means any air pollutant, emissions of which are subject to a standard of performance for new stationary sources but for which air quality criteria have not been issued, and which is not included on a list published under section 108(a) or section 112(b)(1)(A) of the Act.

(b) "Designated facility" means any existing facility (see § 60.2(aa)) which emits a designated pollutant and which would be subject to a standard of performance for that pollutant if the existing facility were an affected facility (see § 60.2(e)).

(c) "Plan" means a plan under section 111(d) of the Act which establishes emission standards for designated pollutants from designated facilities and provides for the implementation and enforcement of such emission standards.

(d) "Applicable plan" means the plan, or most recent revision thereof, which has been approved under § 60.27(b) or promulgated under § 60.27(d).

(e) "Emission guideline" means a guideline set forth in subpart C of this part, or in a final guideline document published under § 60.22(a), which reflects the degree of emission reduction achievable through the application of the best system of emission reduction which (taking into account the cost of such reduction) the Administrator has determined has been adequately demonstrated for designated facilities.

(f) "Emission standard" means a legally enforceable regulation setting forth an allowable rate of emissions into the atmosphere, or prescribing equipment specifications for control of air pollution emissions.

(g) "Compliance schedule" means a legally enforceable schedule specifying a date or dates by which a source or category or sources must comply with specific emission standards contained in a plan or with any increments of progress to achieve such compliance.

(h) "Increments of progress" means steps to achieve compliance which must be taken by an owner or operator of a designated facility, including:

(1) Submittal of a final control plan for the designated facility to the appropriate air pollution control agency;

(2) Awarding of contracts for emission control systems or for process modifications, or issuance of orders for the purchase of component parts to accomplish emission control or process modification.

(3) Initiation of on-site construction or installation of emission control equipment or process change;

(4) Completion of on-site construction or installation of emission control equipment or process change; and

(5) Final compliance.

(i) "Region" means an air quality control region designated under section 107 of the Act and described in Part 81 of this chapter.

(j) "Local agency" means any local governmental agency.

§ 60.22 Publication of guideline documents, emission guidelines, and final compliance times.

(a) After promulgation of a standard of performance for the control of a designated pollutant from affected facilities, the Administrator will publish a draft guideline document containing information pertinent to control of the designated pollutant from designated facilities. Notice of the availability of the draft guideline document will be published in the FEDERAL REGISTER, and public comments on its contents will be invited. After consideration of public comments, a final guideline document will be published and notice of its availability will be published in the FEDERAL REGISTER.

(b) Guideline documents published under this section will provide information for the development of State plans, such as:

(1) Information concerning known or suspected endangerment of public health or welfare caused, or contributed to, by the designated pollutant.

(2) A description of systems of emission reduction which, in the judgment of the Administrator, have been adequately demonstrated.

(3) Information on the degree of emission reduction which is achievable with each system, together with information on the costs and environmental effects of applying each system to designated facilities.

(4) Incremental periods of time normally expected to be necessary for the design, installation, and startup of identified control systems.

(5) An emission guideline that reflects the application of the best system of emission reduction (considering the cost of such reduction) that has been adequately demonstrated for designated facilities, and the time within which compliance with emission standards of equivalent stringency can be achieved. The Administrator will specify different emission guidelines or compliance times or both for different sizes, types, and classes of designated facilities when costs of control, physical limitations, geographical location, or similar factors make subcategorization appropriate.

(6) Such other available information as the Administrator determines may contribute to the formulation of State plans.

(c) Except as provided in paragraph (d)(1) of this section, the emission guidelines and compliance times referred to in paragraph (b)(5) of this section will be proposed for comment upon publication of the draft guideline document, and after consideration of comments will be promulgated in Subpart C of this part with such modifications as may be appropriate.

(d)(1) If the Administrator determines that a designated pollutant may cause or contribute to endangerment of public welfare, but that adverse effects on public health have not been demonstrated, he will include the determination in the draft guideline document and in the FEDERAL REGISTER notice of its availability. Except as provided in paragraph (d)(2) of this section, paragraph (c) of this section shall be inapplicable in such cases.

(2) If the Administrator determines at any time on the basis of new information that a prior determination under paragraph (d)(1) of this section is incorrect or no longer correct, he will publish notice of the determination in the FEDERAL REGISTER, revise the guideline document as necessary under paragraph (a) of this section, and propose and promulgate emission guidelines and compliance times under paragraph (c) of this section.

§ 60.23 Adoption and submittal of State plans; public hearings.

(a)(1) Within nine months after notice of the availability of a final guideline document is published under § 60.22(a), each State shall adopt and submit to the Administrator, in accordance with § 60.4, a plan for the control of the designated pollutant to which the guideline document applies.

(2) Within nine months after notice of the availability of a final revised guideline document is published as provided in § 60.22(d)(2), each State shall adopt and submit to the Administrator any plan revision necessary to meet the requirements of this subpart.

(b) If no designated facility is located within a State, the State shall submit a letter of certification to that effect to the Administrator within the time specified in paragraph (a) of this section. Such certification shall exempt the State from the requirements of this subpart for that designated pollutant.

(c)(1) Except as provided in paragraphs (c)(2) and (c)(3) of this section, the State shall, prior to the adoption of any plan or revision thereof, conduct one or more public hearings within the State on such plan or plan revision.

(2) No hearing shall be required for any change to an increment of progress in an approved compliance schedule unless the change is likely to cause the facility to be unable to comply with the final compliance date in the schedule.

(3) No hearing shall be required on an emission standard in effect prior to the effective date of this subpart if it was adopted after a public hearing and is at least as stringent as the corresponding emission guideline specified in the applicable guideline document published under § 60.22(a).

(d) Any hearing required by paragraph (c) of this section shall be held only after reasonable notice. Notice shall be given at least 30 days prior to the date of such hearing and shall include:

(1) Notification to the public by prominently advertising the date, time, and place of such hearing in each region affected;

(2) Availability, at the time of public announcement, of each proposed plan or revision thereof for public inspection in at least one location in each region to which it will apply;

(3) Notification to the Administrator;

(4) Notification to each local air pollution control agency in each region to which the plan or revision will apply; and

(5) In the case of an interstate region, notification to any other State included in the region.

(e) The State shall prepare and retain, for a minimum of 2 years, a record of each hearing for inspection by any interested party. The record shall contain, as a minimum, a list of witnesses together with the text of each presentation.

(f) The State shall submit with the plan or revision:

(1) Certification that each hearing required by paragraph (c) of this section was held in accordance with the notice required by paragraph (d) of this section; and

(2) A list of witnesses and their organizational affiliations, if any, appearing at the hearing and a brief written summary of each presentation or written submission.

(g) Upon written application by a State agency (through the appropriate Regional Office), the Administrator may approve State procedures designed to insure public participation in the matters for which hearings are required and public notification of the opportunity to participate if, in the judgment of the Administrator, the procedures, although different from the requirements of this subpart, in fact provide for adequate notice to and participation of the public. The Administrator may impose such conditions on his approval as he deems necessary. Procedures approved under this section shall be deemed to satisfy the requirements of this subpart regarding procedures for public hearings.

§ 60.24 Emission standards and compliance schedules.

(a) Each plan shall include emission standards and compliance schedules.

(b)(1) Emission standards shall prescribe allowable rates of emissions except when it is clearly impracticable. Such cases will be identified in the guideline documents issued under § 60.22. Where emission standards prescribing equipment specifications are established, the plan shall, to the degree possible, set forth the emission reductions achievable by implementation of such specifications, and may permit compliance by the use of equipment determined by the State to be equivalent to that prescribed.

(2) Test methods and procedures for determining compliance with the emission standards shall be specified in the plan. Methods other than those specified in Appendix A to this part may be specified in the plan if shown to be equivalent or alternative methods as defined in § 60.2 (t) and (u).

(3) Emission standards shall apply to all designated facilities within the State. A plan may contain emission standards adopted by local jurisdictions provided that the standards are enforceable by the State.

(c) Except as provided in paragraph (f) of this section, where the Administrator has determined that a designated pollutant may cause or contribute to endangerment of public health, emission standards shall be no less stringent than the corresponding emission guideline(s) specified in subpart C of this part, and final compliance shall be required as expeditiously as practicable but no later than the compliance times specified in Subpart C.

(d) Where the Administrator has determined that a designated pollutant may cause or contribute to endangerment of public welfare but that adverse effects on public health have not been demonstrated, States may balance the emission guidelines, compliance times, and other information provided in the applicable guideline document against other factors of public concern in establishing emission standards, compliance schedules, and variances. Appropriate consideration shall be given to the factors specified in § 60.22(b) and to information presented at the public hearing(s) conducted under § 60.23(c).

(e)(1) Any compliance schedule extending more than 12 months from the date required for submittal of the plan shall include legally enforceable increments of progress to achieve compliance for each designated facility or category of facilities. Increments of progress shall include, where practicable, each increment of progress specified in § 60.21(h) and shall include such additional increments of progress as may be necessary to permit close and effective supervision of progress toward final compliance.

(2) A plan may provide that compliance schedules for individual sources or categories of sources will be formulated after plan submittal. Any such schedule shall be the subject of a public hearing held according to § 60.23 and shall be submitted to the Administrator within 60 days after the date of adoption of the schedule but in no case later than the date prescribed for submittal of the first semiannual report required by § 60.25(e).

(f) On a case-by-case basis for particular designated facilities, or classes of facilities, States may provide for the application of less stringent emission standards or longer compliance schedules than those otherwise required by paragraph (c) of this section, provided that the State demonstrates with respect to each such facility (or class of facilities):

(1) Unreasonable cost of control resulting from plant age, location, or basic process design;

(2) Physical impossibility of installing necessary control equipment; or

(3) Other factors specific to the facility (or class of facilities) that make application of a less stringent standard or final compliance time significantly more reasonable.

(g) Nothing in this subpart shall be construed to preclude any State or political subdivision thereof from adopting or enforcing (1) emission standards more stringent than emission guidelines specified in subpart C of this part or in applicable guideline documents or (2) compliance schedules requiring final compliance at earlier times than those specfied in subpart C or in applicable guideline documents.

§ 60.25 Emission inventories, source surveillance, reports.

(a) Each plan shall include an inventory of all designated facilities, including emission data for the designated pollutants and information related to emissions as specified in Appendix D to this part. Such data shall be summarized in the plan, and emission rates of designated pollutants from designated facilities shall be correlated with applicable emission standards. As used in this subpart, "correlated" means presented in such a manner as to show the relationship between measured or estimated amounts of emissions and the amounts of such emissions allowable under applicable emission standards.

(b) Each plan shall provide for monitoring the status of compliance with applicable emission standards. Each plan shall, as a minimum, provide for:

(1) Legally enforceable procedures for requiring owners or operators of designated facilities to maintain records and periodically report to the State information on the nature and amount of emissions from such facilities, and/or such other information as may be necessary to enable the State to determine whether such facilities are in compliance with applicable portions of the plan.

(2) Periodic inspection and, when applicable, testing of designated facilities.

(c) Each plan shall provide that information obtained by the State under paragraph (b) of this section shall be correlated with applicable emission standards (see § 60.25(a)) and made available to the general public.

(d) The provisions referred to in paragraphs (b) and (c) of this section shall be specifically identified. Copies of such provisions shall be submitted with the plan unless:

(1) They have been approved as portions of a preceding plan submitted under this subpart or as portions of an implementation plan submitted under section 110 of the Act, and

(2) The State demonstrates:

(i) That the provisions are applicable to the designated pollutant(s) for which the plan is submitted, and

(ii) That the requirements of § 60.26 are met.

(e) The State shall submit reports on progress in plan enforcement to the Administrator on a semiannual basis, commencing with the first full report period after approval of a plan or after promulgation of a plan by the Administrator. The semiannual periods are January 1–June 30 and July 1–December 31. Information required under this paragraph shall be included in the semiannual reports required by § 51.7 of this chapter.

(f) Each progress report shall include:

(1) Enforcement actions initiated against designated facilities during the reporting period, under any emission standard or compliance schedule of the plan.

(2) Identification of the achievement of any increment of progress required by the applicable plan during the reporting period.

(3) Identification of designated facilities that have ceased operation during the reporting period.

(4) Submission of emission inventory data as described in paragraph (a) of this section for designated facilities that were not in operation at the time of plan development but began operation during the reporting period.

(5) Submission of additional data as necessary to update the information submitted under paragraph (a) of this section or in previous progress reports.

(6) Submission of copies of technical reports on all performance testing on designated facilities conducted under paragraph (b)(2) of this section, complete with concurrently recorded process data.

§ 60.26 Legal authority.

(a) Each plan shall show that the State has legal authority to carry out the plan, including authority to:

(1) Adopt emission standards and compliance schedules applicable to designated facilities.

(2) Enforce applicable laws, regulations, standards, and compliance schedules, and seek injunctive relief.

(3) Obtain information necessary to determine whether designated facilities are in compliance with applicable laws, regulations, standards, and compliance schedules, including authority to require recordkeeping and to make inspections and conduct tests of designated facilities.

(4) Require owners or operators of designated facilities to install, maintain, and use emission monitoring devices and to make periodic reports to the State on the nature and amounts of emissions from such facilities; also authority for the State to make such data available to the public as reported and as correlated with applicable emission standards.

(b) The provisions of law or regulations which the State determines provide the authorities required by this section shall be specifically identified. Copies of such laws or regulations shall be submitted with the plan unless:

(1) They have been approved as portions of a preceding plan submitted under this subpart or as portions of an implementation plan submitted under section 110 of the Act, and

(2) The State demonstrates that the laws or regulations are applicable to the designated pollutant(s) for which the plan is submitted.

(c) The plan shall show that the legal authorities specified in this section are available to the State at the time of submission of the plan. Legal authority adequate to meet the requirements of paragraphs (a)(3) and (4) of this section may be delegated to the State under section 114 of the Act.

(d) A State governmental agency other than the State air pollution control agency may be assigned responsibility for carrying out a portion of a plan if the plan demonstrates to the Administrator's satisfaction that the State governmental agency has the legal authority necessary to carry out that portion of the plan.

(e) The State may authorize a local agency to carry out a plan, or portion thereof, within the local agency's jurisdiction if the plan demonstrates to the Administrator's satisfaction that the local agency has the legal authority necessary to implement the plan or portion thereof, and that the authorization does not relieve the State of responsibility under the Act for carrying out the plan or portion thereof.

§ 60.27 Actions by the Administrator.

(a) The Administrator may, whenever he determines necessary, extend the period for submission of any plan or plan revision or portion thereof.

(b) After receipt of a plan or plan revision, the Administrator will propose the plan or revision for approval or disapproval. The Administrator will, within four months after the date required for submission of a plan or plan revision, approve or disapprove such plan or revision or each portion thereof.

(c) The Administrator will, after consideration of any State hearing record, promptly prepare and publish proposed regulations setting forth a plan, or portion thereof, for a State if:

(1) The State fails to submit a plan within the time prescribed;

(2) The State fails to submit a plan revision required by § 60.23(a)(2) within the time prescribed; or

(3) The Administrator disapproves the State plan or plan revision or any portion thereof, as unsatisfactory because the requirements of this subpart have not been met.

(d) The Administrator will, within six months after the date required for submission of a plan or plan revision, promulgate the regulations proposed under paragraph (c) of this section with such modifications as may be appropriate unless, prior to such promulgation, the State has adopted and submitted a plan or plan revision which the Administrator determines to be approvable.

(e)(1) Except as provided in paragraph (e)(2) of this section, regulations proposed and promulgated by the Administrator under this section will prescribe emission standards of the same stringency as the corresponding emission guideline(s) specified in the final guideline document published under § 60.22(a) and will require final compliance with such standards as expeditiously as practicable but no later than the times specified in the guideline document.

(2) Upon application by the owner or operator of a designated facility to which regulations proposed and promulgated under this section will apply, the Administrator may provide for the application of less stringent emission standards or longer compliance schedules than those otherwise required by this section in accordance with the criteria specified in § 60.24(f).

(f) If a State failed to hold a public hearing as required by § 60.23(c), the Administrator will provide opportunity for a hearing within the State prior to promulgation of a plan under paragraph (d) of this section.

§ 60.28 Plan revisions by the State.

(a) Plan revisions which have the effect of delaying compliance with applicable emission standards or increments of progress or of establishing less stringent emission standards shall be submitted to the Administrator within 60 days after adoption in accordance with the procedures and requirements applicable to development and submission of the original plan.

(b) More stringent emission standards or orders which have the effect of accelerating compliance, may be submitted to the Administrator as plan revisions in accordance with the procedures and requirements applicable to development and submission of the original plan.

(c) A revision of a plan, or any portion thereof, shall not be considered part of an applicable plan until approved by the Administrator in accordance with this subpart.

§ 60.29 Plan revisions by the Administrator.

After notice and opportunity for public hearing in each affected State, the Administrator may revise any provision of an applicable plan if:

(a) The provision was promulgated by the Administrator, and

(b) The plan, as revised, will be consistent with the Act and with the requirements of this subpart.

5. Part 60 is amended by adding Appendix D as follows:

APPENDIX D—REQUIRED EMISSION INVENTORY INFORMATION

(a) Completed NEDS point source form(s) for the entire plant containing the designated facility, including information on the applicable criteria pollutants. If data concerning the plant are already in NEDS, only that information must be submitted which is necessary to update the existing NEDS record for that plant. Plant and point identification codes for NEDS records shall correspond to those previously assigned in NEDS; for plants not in NEDS, these codes shall be obtained from the appropriate Regional Office.

(b) Accompanying the basic NEDS information shall be the following information on each designated facility:

(1) The state and county identification codes, as well as the complete plant and point identification codes of the designated facility in NEDS. (The codes are needed to match these data with the NEDS data.)

(2) A description of the designated facility including, where appropriate:

(i) Process name.

(ii) Description and quantity of each product (maximum per hour and average per year).

(iii) Description and quantity of raw materials handled for each product (maximum per hour and average per year).

(iv) Types of fuels burned, quantities and characteristics (maximum and average quantities per hour, average per year).

(v) Description and quantity of solid wastes generated (per year) and method of disposal.

(3) A description of the air pollution control equipment in use or proposed to control the designated pollutant, including:

(i) Verbal description of equipment.

(ii) Optimum control efficiency, in percent. This shall be a combined efficiency when more than one device operate in series. The method of control efficiency determination shall be indicated (e.g., design efficiency, measured efficiency, estimated efficiency).

(iii) Annual average control efficiency, in percent, taking into account control equipment down time. This shall be a combined efficiency when more than one device operate in series.

(4) An estimate of the designated pollutant emissions from the designated facility (maximum per hour and average per year). The method of emission determination shall also be specified (e.g., stack test, material balance, emission factor).

(Secs. 111, 114, and 301 of the Clean Air Act, as amended by sec. 4(a) of Pub. L. 91-604, 84 Stat. 1678, and by sec. 15(c)(2) of Pub. L. 91-604, 84 Stat. 1713 (42 U.S.C. 1857c-6, 1857c-9, 1857g))

[FR Doc.75-30611 Filed 11-14-75;8:45 am]

22 Title 40—Protection of Environment

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

SUBCHAPTER C—AIR PROGRAMS

[FRL 402-8]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Modification, Notification, and Reconstruction

On October 15, 1974 (39 FR 36946), under section 111 of the Clean Air Act, as amended (42 U.S.C. 1857), the Environmental Protection Agency (EPA) proposed amendments to the general provisions of 40 CFR Part 60. These amendments included additions and revisions to clarify the definition of the term "modification" appearing in the Act, to require notification of construction or potential modification, and to clarify when standards of performance are applicable to reconstructed sources. These regulations apply to all stationary sources constructed or modified after the proposal date of an applicable standard of performance.

Interested parties participated in the rulemaking by sending comments to EPA. Fifty-three comment letters were received, 43 of which came from industry, with the remainder coming from State and Federal agencies. Copies of the comment letters received and a summary of the comments with EPA's responses are available for public inspection and copying at the EPA Public Information Reference Unit, Room 2922 (EPA Library), 401 M Street SW., Washington, D.C. In addition, copies of the comment summary and Agency responses may be obtained upon written request from the EPA Public Information Center (PM-215), 401 M Street SW., Washington, D.C. 20460 (specify Public Comment Summary—Modification, Notification, and Reconstruction). The comments have been carefully considered, and where determined by the Administrator to be appropriate, changes have been made to the proposed regulations and are incorporated in the regulations promulgated herein. The most significant comments and the differences between the proposed and promulgated regulations are discussed below.

TERMINOLOGY

Understandably there has been some confusion as to the difference between the various types of "sources" and "facilities" defined in § 60.2 of these regulations. Generally speaking, "sources" are entire plants, while "facilities" are identifiable pieces of process equipment or individual components which when taken together would comprise a source. "Affected facilities" are facilities subject to standards of performance, and are specifically identified in the first section of each subpart of Part 60. An "existing facility" is generally a piece of equipment or component of the same type as an affected facility, but which differs in that it was constructed prior to the date of proposal of an applicable standard of performance. This distinction is somewhat complicated because an existing facility which undergoes a modification within the meaning of the Act and these regulations becomes an affected facility. However, generally speaking, the distinction between "affected facilities" and "existing facilities" depends on the date of construction. The terms are intended to be the direct regulatory counterparts of the statutory definitions of "new source" and "existing source" appearing in section 111 of the Act.

"Designated facilities" form a subcategory of "existing facilities." A "designated facility" is an existing facility which emits a "designated pollutant," i.e., a pollutant which is neither a hazardous pollutant, as defined by section 112 of the Act, nor a pollutant subject to national ambient air quality standards. The term "designated facilities," however, has no special relevance to the issue of modification.

DEFINITION OF "CAPITAL EXPENDITURE"

Several commentators argued that the proposed definition of "capital expenditure," as applicable to the exemption for increasing the production rate of an existing facility in § 60.14(e)(2), was too vague. The regulations promulgated herein correct this deficiency by incorporating by reference and by requiring the application of the procedure contained in Internal Revenue Service Publication 534, which is available from any IRS office. The procedure set forth in IRS Publication 534 is relatively straightforward. First, the total cost of increasing the production or operating rate must be determined. All expenditures necessary to increasing the facility's operating rate must be included in this total. However, for purposes of § 60.14(e)(2) this amount must not be reduced by any "excluded additions," as defined in IRS Publication 534, as would be done for tax purposes. Next, the facility's basis (usually its cost), as defined by Section 1012 of the Internal Revenue Code, must be determined. If the product of the appropriate "annual asset guideline repair allowance percentage" tabulated in Publication 534 and the facility's basis exceeds the cost of increasing the operating rate, the change will not be treated as a modification. Conversely, if the cost of making the change is more than the above product and the emissions have increased, the change will be treated as a modification.

The advantage of adopting the procedure in IRS Publication 534 is that firm and precise guidance is provided as to what constitutes a capital expenditure. The procedure involves concepts and information which are available to all owners and operators and with which they are familiar, and it is the Administrator's opinion that it adequately responds to the complaints of vagueness made in comments.

NOTIFICATION OF CONSTRUCTION

The regulations promulgated herein contain a requirement that owners or operators notify EPA within 30 days of the commencement of construction of an affected facility. Some commentators, however, questioned the Agency's legal authority to require such a notification and questioned the need for such information.

Section 301(a) of the Act provides the Administrator authority to issue regulations "necessary to carry out his functions under [the] Act." The Agency has learned through experience with administering the new source performance standards that knowledge of the sources which may become subject to the standards is important to the effective implementation of section 111. This notification will not be used for approval or disapproval of the planned construction: the purpose is to allow the Administrator to locate sources which will be subject to the regulations appearing in this part, and to enable the Administrator to inform the sources about applicable regulations in an effort to minimize future problems. In the case of mass produced facilities, which are purchased by the ultimate user when construction is completed, the construction notification requirement will not apply. Notification prior to startup, however will still be required.

USE OF EMISSION FACTORS

The proposed regulations listed emission factors as one possible method to be used in determining whether a facility has increased its emissions. Emission factors have two major advantages. First, they are inexpensive to use. Second, they may be applied prospectively, i.e., they can be used in some cases to determine whether a particular change *will* increase a facility's emissions before the change is implemented. This is important to owners or operators since they can thereby obtain advance notice of the consequences of proposed changes they are planning prior to commitment to a particular course of action. Emission factors do not, however, provide results as precise as other methods, such as actual stack testing. Nevertheless, in many cases the emission consequences of a proposed change can be reliably predicted by the use of emission factors. In such cases, where emissions will clearly increase or will clearly not increase, the Agency will rely primarily on emission factors. Only where the resulting change in emission rate is ambiguous, or where a dispute arises as to the result obtained by the use of emission factors, will other methods be used. Section 60.14(b) has been revised to reflect this policy.

THE "BUBBLE CONCEPT"

The phrase "bubble concept" has been used to refer to the trading off of emission increases from one facility undergoing a physical or operational change with emission reductions from another facility, in order to achieve no net increase in the amount of any air pollutant (to which a standard applies) emitted into the atmosphere by the stationary source taken as a whole.

Several commentators suggested that the "bubble concept" be extended to cover "new construction." Under the proposed regulations, the "bubble concept" could be utilized to offset emission increases from a facility undergoing a physical or operational change (as distinguished from a "new facility") at a lower economic cost than would arise if the facility undergoing the change were to be considered by EPA as being modified within the meaning of section 111 of the Act and consequently required to meet standards of performance. Under the suggested approach a new facility could be added to an existing source without having to meet otherwise applicable standards of performance, provided the amount of any air pollutant (to which a standard applies) emitted into the atmosphere by the stationary source taken as a whole did not increase. If adopted, this suggestion could exempt most new construction at existing sources from having to comply with otherwise applicable standards of performance. Such an interpretation of the section 111 provisions of the Act would grant a significant and unfair economic advantage to owners or operators of existing sources replacing facilities with new construction as compared to someone wishing to construct an entirely new source.

If the bubble concept were extended to cover new construction, large sources of air pollution could avoid the application of new source performance standards indefinitely. Such sources could continually replace obsolete or worn out facilities with new facilities of the same type. If the same emission controls were adopted, no overall emission increase would result. In this manner, the source could continue indefinitely without ever being required to upgrade air pollution control systems to meet standards of performance for new facilities. The Administrator interprets section 111 to require that new producers of emissions be subject to the standards whether constructed at a new plant site or an existing one. Therefore, where a new facility is constructed, new source performance standards must be met. In situations involving physical or operational changes to an existing facility which increase emissions from that facility, greater flexibility is permitted to avoid the imposition of large control costs if the projected increase can be offset by controlling other plant facilities.

Several commentators argued that if the Administrator adopted the proposed interpretation of the term "modification", which would consider a modification to have occurred even if there was only a relatively minor detectable emission rate increase (thus requiring application of standards of performance), the Administrator would in effect prevent owners or operators from implementing physical or operational changes necessary to switch from gas and oil to coal in comport with the President's policy of reducing gas and oil consumption. The Administrator has concluded that if such situations exist, they will be relatively rare and, in any event, will be peculiar to the group of facilities covered by a particular standard of performance rather than to all facilities in general. Therefore, the Administrator has further concluded that it would be more appropriate to consider such circumstances and possible avenues of relief in connection with the promulgation of or amendment to particular standards of performance rather than through the amendment of the general provisions of 40 CFR Part 60.

Where the use of the bubble concept is elected by an owner or operator, some guarantee is necessary to insure that emissions do not subsequently increase above the level present before the physical or operational change in question. For example, reducing a facility's operating rate is a permissible means of offsetting emission increases from another facility undergoing a physical or operational change. If the exemption provided by § 60.14(e)(2) as promulgated herein were subsequently used to increase the first facility's operating rate back to the prior level, the intent of the Act would be circumvented and the compliance measures previously adopted would be nullified. Therefore, in those cases where utilization of the exemptions under § 60.14(e) (2), (3), or (4) as promulgated herein would effectively negate the compliance measures originally adopted, use of those exemptions will not be permitted.

One limitation placed on utilization of the "bubble concept" by the proposed regulation was that emission reductions could be credited only if achieved at an "existing" or "affected" facility. The purpose of this requirement was to limit the "bubble concept" to those facilities which could be source tested by EPA reference methods. One commentator pointed out that some facilities other than "existing" or "affected" facilities (i.e., facilities of the type for which no standards have been promulgated) lend themselves to accurate emission measurement. Therefore, § 60.14(d) has been revised to permit emission reductions to be credited from all facilities whose emissions can be measured by reference, equivalent, or alternative methods, as defined in § 60.2 (s), (t), and (u). In addition, when a facility which cannot be tested by any of these methods is permanently closed, the regulations have been revised to permit emission rate reductions from such closures to be used to offset emission rate increases if methods such as emission factors clearly show, to the Administrator's satisfaction that the reduction offsets any increase. The regulation does not allow facilities which cannot be tested by any of these methods to reduce their production as a means of reducing emissions to offset emission rate increases because establishing allowable emissions for such facilities and monitoring compliance to insure that the allowable emissions are not exceeded would be very difficult and even impossible in many cases.

Also, under the proposed regulations applicable to the "bubble concept," actual emission testing was the only permissible method for demonstrating that there has been no increase in the total emission rate of any pollutant to which a standard applies from all facilities within the stationary source. Several commentators correctly argued that if methods such as emission factors are sufficiently accurate to determine emission rates under other sections of the regulation [i.e. § 60.14(b)], they should be adequate for the purposes of utilization of the bubble concept. Thus, the regulations have been revised to permit the use of emission factors in those cases where it can be demonstrated to the Administrator's satisfaction that they will clearly show that total emissions will or will not increase. Where the Administrator is not convinced of the reliability of emission factors in a particular case, other methods will be required.

OWNERSHIP CHANGE

The regulation has been amended by adding § 60.14(e)(6) which states that a change in ownership or relocating a source does not by itself bring a source under these modification regulations.

RECONSTRUCTION

Several commentators questioned the Agency's legal authority to propose standards of performance on reconstructed sources. Many commentators further believed that the Agency is attempting to delete the emission increase requirement from the definition of modification. The Agency's actual intent is to prevent circumvention of the law. Section 111 of the Act requires compliance with standards of performance in two cases, new construction and modification. The reconstruction provision is intended to apply where an existing facility's components are replaced to such an extent that it is technologically and economically feasible for the reconstructed facility to comply with the applicable standards of performance. In the case of an entirely new facility the proper time to apply the best adequately demonstrated control technology is when the facility is originally constructed. As explained in the preamble to the proposed regulation, the purpose of the reconstruction provision is to recognize that replacement of many of the components of a facility can be substantially equivalent to totally replacing it at the end of its useful life with a newly constructed affected facility. For existing facilities which substantially retain their character as existing facilities, application of best adequately demonstrated control technology is considered appropriate when any physical or operational change is made which causes an increase in emissions to the atmosphere (this is modification). Thus, the criteria for "reconstruction" are independent from the criteria for "modification."

Sections 60.14 and 60.15 set up the procedures and criteria to be used in making the determination to apply best adequately demonstrated control technology to existing facilities to which some changes have been made.

Under the proposed regulations, the replacement of a substantial portion of an existing facility's components constituted reconstruction. Many commentators questioned the meaning of "substantial portion." After considering the comments and the vagueness of this term, the Agency decided to revise the proposed reconstruction provisions to better clarify to owners or operators what actions they must take and what action the Administrator will take. Section 60.15 of the regulations as revised specifies that reconstruction occurs upon replacement of components if the fixed capital cost of the new components exceeds 50 percent of the fixed capital cost that would be required to construct a comparable entirely new facility and it is technologically and economically feasible for the facility after the replacements to comply with the applicable standards of performance. The 50 percent replacement criteria is designed merely to key the notification to the Administrator; it is not an independent basis for the Administrator's determination. The term "fixed capital cost" is defined as the capital needed to provide all the depreciable components and is intended to include such things as the costs of engineering, purchase, and installation of major process equipment, contractors' fees, instrumentation, auxiliary facilities, buildings, and structures. Costs associated with the purchase and installation of air pollution control equipment (e.g., baghouses, electrostatic precipitators, scrubbers, etc.) are not considered in estimating the fixed capital cost of a comparable entirely new facility unless that control equipment is required as part of the process (e.g., product recovery).

The revised § 60.15 leaves the final determination with the Administrator as to when it is technologically and economically feasible to comply with the applicable standards of performance. Further clarification and definition is not possible because the spectrum of replacement projects that will take place in the future at existing facilities is so broad that it is not possible to be any more specific. Section 60.15 sets forth the criteria which the Administrator will use in making his determination. For example, if the estimated life of the facility after the replacements is significantly less than the estimated life of a new facility, the replacement may not be considered reconstruction. If the equipment being replaced does not emit or cause an emission of an air pollutant, it may be determined that controlling the components that do emit air pollutants is not reasonable considering cost, and standards of performance for new sources should not be applied. If there is insufficient space after the replacements at an existing facility to install the necessary air pollution control system to comply with the standards of performance, then reconstruction would not be determined to have occurred. Finally, the Administrator will consider all technical and economic limitations the facility may have in complying with the applicable standards of performance after the proposed replacements.

While § 60.15 expresses the basic Agency policy and interpretation regarding reconstruction, individual subparts may refine and delimit the concept as applied to individual categories of facilities.

RESPONSE TO REQUESTS FOR DETERMINATION

Section 60.5 has been revised to indicate that the Administrator will make a determination of whether an action by an owner or operator constitutes reconstruction within the meaning of § 60.15. Also, in response to a public comment, a new § 60.5(b) has been added to indicate the Administrator's intention to respond to requests for determinations within 30 days of receipt of the request.

STATISTICAL TEST

Appendix C of the regulation incorporates a statistical procedure for determining whether an emission increase has occurred. Several individuals commented on the procedure as proposed. After considering all these comments and conducting further study into the subject, the Administrator has determined that a statistical procedure is substantially superior to a method comparing average emissions, and that no other statistical procedure is clearly superior to the one adopted (Student's t test). A more detailed analysis of this issue can be found in EPA's responses to the comments mentioned previously.

Effective date. These regulations are effective on December 16, 1975. Since they represent a clarification of the Agency's existing enforcement policy, good cause is found for not delaying the effective date, as required by 5 U.S.C. 553(d)(3). However, the regulations will, in effect, apply retroactively to any enforcement activity now in progress since they do reflect present Agency policy.

(Sections 111, 114, and 301 of the Clean Air Act, as amended (42 U.S.C. 1857c-6, 1857c-9, and 1857g))

Dated: December 8, 1975.

RUSSELL E. TRAIN,
Administrator.

Part 60 of Chapter I, Title 40 of the Code of Federal Regulations is amended as follows:

1. The table of sections is amended by adding §§ 60.14 and 60.15 and Appendix C as follows:

Subpart A—General Provisions

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Sec.
60.14 Modification.
60.15 Reconstruction.

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Appendix C—Determination of Emission Rate Change.

2. In § 60.2, paragraphs (d) and (h) are revised and paragraphs (aa) and (bb) are added as follows:

§ 60.2 Definitions.

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(d) "Stationary source" means any building, structure, facility, or installation which emits or may emit any air pollutant and which contains any one or combination of the following:

(1) Affected facilities.

(2) Existing facilities.

(3) Facilities of the type for which no standards have been promulgated in this part.

* * * * *

(h) "Modification" means any physical change in, or change in the method of operation of, an existing facility which increases the amount of any air pollutant (to which a standard applies) emitted into the atmosphere by that facility or which results in the emission of any air pollutant (to which a standard applies) into the atmosphere not previously emitted.

* * * * *

(aa) "Existing facility" means, with reference to a stationary source, any apparatus of the type for which a standard is promulgated in this part, and the construction or modification of which was commenced before the date of proposal of that standard; or any apparatus which could be altered in such a way as to be of that type.

(bb) "Capital expenditure" means an expenditure for a physical or operational change to an existing facility which exceeds the product of the applicable "annual asset guideline repair allowance percentage" specified in the latest edition of Internal Revenue Service Publication 534 and the existing facility's basis, as defined by section 1012 of the Internal Revenue Code.

3. Section 60.5 is revised to read as follows:

§ 60.5 Determination of construction or modification.

(a) When requested to do so by an owner or operator, the Administrator will make a determination of whether action taken or intended to be taken by such owner or operator constitutes construction (including reconstruction) or modification or the commencement thereof within the meaning of this part.

(b) The Administrator will respond to any request for a determination under paragraph (a) of this section within 30 days of receipt of such request.

4. In § 60.7, paragraphs (a)(1) and (a)(2) are revised, and paragraphs (a)(3), (a)(4), and (e) are added as follows:

§ 60.7 Notification and recordkeeping.

(a) Any owner or operator subject to the provisions of this part shall furnish the Administrator written notification as follows:

(1) A notification of the date construction (or reconstruction as defined under § 60.15) of an affected facility is commenced postmarked no later than 30 days after such date. This requirement shall not apply in the case of mass-produced facilities which are purchased in completed form.

(2) A notification of the anticipated date of initial startup of an affected facility postmarked not more than 60 days nor less than 30 days prior to such date.

(3) A notification of the actual date of initial startup of an affected facility postmarked within 15 days after such date.

(4) A notification of any physical or operational change to an existing facility which may increase the emission rate of any air pollutant to which a standard applies, unless that change is spe-

cifically exempted under an applicable subpart or in § 60.14(e) and the exemption is not denied under § 60.14(d)(4). This notice shall be postmarked 60 days or as soon as practicable before the change is commenced and shall include information describing the precise nature of the change, present and proposed emission control systems, productive capacity of the facility before and after the change, and the expected completion date of the change. The Administrator may request additional relevant information subsequent to this notice.

* * * * *

(e) If notification substantially similar to that in paragraph (a) of this section is required by any other State or local agency, sending the Administrator a copy of that notification will satisfy the requirements of paragraph (a) of this section.

5. Subpart A is amended by adding §§ 60.14 and 60.15 as follows:

§ 60.14 Modification.

(a) Except as provided under paragraphs (d), (e) and (f) of this section, any physical or operational change to an existing facility which results in an increase in the emission rate to the atmosphere of any pollutant to which a standard applies shall be considered a modification within the meaning of section 111 of the Act. Upon modification, an existing facility shall become an affected facility for each pollutant to which a standard applies and for which there is an increase in the emission rate to the atmosphere.

(b) Emission rate shall be expressed as kg/hr of any pollutant discharged into the atmosphere for which a standard is applicable. The Administrator shall use the following to determine emission rate:

(1) Emission factors as specified in the latest issue of "Compilation of Air Pollutant Emission Factors," EPA Publication No. AP-42, or other emission factors determined by the Administrator to be superior to AP-42 emission factors, in cases where utilization of emission factors demonstrate that the emission level resulting from the physical or operational change will either clearly increase or clearly not increase.

(2) Material balances, continuous monitor data, or manual emission tests in cases where utilization of emission factors as referenced in paragraph (b)(1) of this section does not demonstrate to the Administrator's satisfaction whether the emission level resulting from the physical or operational change will either clearly increase or clearly not increase, or where an owner or operator demonstrates to the Administrator's satisfaction that there are reasonable grounds to dispute the result obtained by the Administrator utilizing emission factors as referenced in paragraph (b)(1) of this section. When the emission rate is based on results from manual emission tests or continuous monitoring systems, the procedures specified in Appendix C of this part shall be used to determine whether an increase in emission rate has occurred. Tests shall be conducted under such conditions as the Administrator shall specify to the owner or operator based on representative performance of the facility. At least three valid test runs must be conducted before and at least three after the physical or operational change. All operating parameters which may affect emissions must be held constant to the maximum feasible degree for all test runs.

(c) The addition of an affected facility to a stationary source as an expansion to that source or as a replacement for an existing facility shall not by itself bring within the applicability of this part any other facility within that source.

(d) A modification shall not be deemed to occur if an existing facility undergoes a physical or operational change where the owner or operator demonstrates to the Administrator's satisfaction (by any of the procedures prescribed under paragraph (b) of this section) that the total emission rate of any pollutant has not increased from all facilities within the stationary source to which appropriate reference, equivalent, or alternative methods, as defined in § 60.2 (s), (t) and (u), can be applied. An owner or operator may completely and permanently close any facility within a stationary source to prevent an increase in the total emission rate regardless of whether such reference, equivalent or alternative method can be applied, if the decrease in emission rate from such closure can be adequately determined by any of the procedures prescribed under paragraph (b) of this section. The owner or operator of the source shall have the burden of demonstrating compliance with this section.

(1) Such demonstration shall be in writing and shall include: (i) The name and address of the owner or operator.

(ii) The location of the stationary source.

(iii) A complete description of the existing facility undergoing the physical or operational change resulting in an increase in emission rate, any applicable control system, and the physical or operational change to such facility.

(iv) The emission rates into the atmosphere from the existing facility of each pollutant to which a standard applies determined before and after the physical or operational change takes place, to the extent such information is known or can be predicted.

(v) A complete description of each facility and the control systems, if any, for those facilities within the stationary source where the emission rate of each pollutant in question will be decreased to compensate for the increase in emission rate from the existing facility undergoing the physical or operational change.

(vi) The emission rates into the atmosphere of the pollutants in question from each facility described under paragraph (d)(1)(v) of this section both before and after the improvement or installation of any applicable control system or any physical or operational changes to such facilities to reduce emission rate.

(vii) A complete description of the procedures and methods used to determine the emission rates.

(2) Compliance with paragraph (d) of this section may be demonstrated by the methods listed in paragraph (b) of this section, where appropriate. Decreases in emissions resulting from requirements of a State implementation plan approved or promulgated under Part 52 of this chapter will not be acceptable. The required reduction in emission rate may be accomplished through the installation or improvement of a control system or through physical or operational changes to facilities including reducing the production of a facility or closing a facility.

(3) Emission rates established for the existing facility which is undergoing a physical or operational change resulting in an increase in the emission rate, and established for the facilities described under paragraph (d)(1)(v) of this section shall become the baseline for determining whether such facilities undergo a modification or are in compliance with standards.

(4) Any emission rate in excess of that rate established under paragraph (d)(3) of this section shall be a violation of these regulations except as otherwise provided in paragraph (e) of this section. However, any owner or operator electing to demonstrate compliance under this paragraph (d) must apply to the Administrator to obtain the use of any exemptions under paragraphs (e)(2), (e)(3), and (e)(4) of this section. The Administrator will grant such exemption only if, in his judgment, the compliance originally demonstrated under this paragraph will not be circumvented or nullified by the utilization of the exemption.

(5) The Administrator may require the use of continuous monitoring devices and compliance with necessary reporting procedures for each facility described in paragraph (d)(1)(iii) and (d)(1)(v) of this section.

(e) The following shall not, by themselves, be considered modifications under this part:

(1) Maintenance, repair, and replacement which the Administrator determines to be routine for a source category, subject to the provisions of paragraph (c) of this section and § 60.15.

(2) An increase in production rate of an existing facility, if that increase can be accomplished without a capital expenditure on the stationary source containing that facility.

(3) An increase in the hours of operation.

(4) Use of an alternative fuel or raw material if, prior to the date any standard under this part becomes applicable to that source type, as provided by § 60.1, the existing facility was designed to accommodate that alternative use. A facility shall be considered to be designed to accommodate an alternative fuel or raw material if that use could be accomplished under the facility's construction

specifications, as amended, prior to the change. Conversion to coal required for energy considerations, as specified in section 119(d)(5) of the Act, shall not be considered a modification.

(5) The addition or use of any system or device whose primary function is the reduction of air pollutants, except when an emission control system is removed or is replaced by a system which the Administrator determines to be less environmentally beneficial.

(6) The relocation or change in ownership of an existing facility.

(f) Special provisions set forth under an applicable subpart of this part shall supersede any conflicting provisions of this section.

(g) Within 180 days of the completion of any physical or operational change subject to the control measures specified in paragraphs (a) or (d) of this section, compliance with all applicable standards must be achieved.

§ 60.15 Reconstruction.

(a) An existing facility, upon reconstruction, becomes an affected facility, irrespective of any change in emission rate.

(b) "Reconstruction" means the replacement of components of an existing facility to such an extent that:

(1) The fixed capital cost of the new components exceeds 50 percent of the fixed capital cost that would be required to construct a comparable entirely new facility, and

(2) It is technologically and economically feasible to meet the applicable standards set forth in this part.

(c) "Fixed capital cost" means the capital needed to provide all the depreciable components.

(d) If an owner or operator of an existing facility proposes to replace components, and the fixed capital cost of the new components exceeds 50 percent of the fixed capital cost that would be required to construct a comparable entirely new facility, he shall notify the Administrator of the proposed replacements. The notice must be postmarked 60 days (or as soon as practicable) before construction of the replacements is commenced and must include the following information:

(1) Name and address of the owner or operator.

(2) The location of the existing facility.

(3) A brief description of the existing facility and the components which are to be replaced.

(4) A description of the existing air pollution control equipment and the proposed air pollution control equipment.

(5) An estimate of the fixed capital cost of the replacements and of constructing a comparable entirely new facility.

(6) The estimated life of the existing facility after the replacements.

(7) A discussion of any economic or technical limitations the facility may have in complying with the applicable standards of performance after the proposed replacements.

(e) The Administrator will determine, within 30 days of the receipt of the notice required by paragraph (d) of this section and any additional information he may reasonably require, whether the proposed replacement constitutes reconstruction.

(f) The Administrator's determination under paragraph (e) shall be based on:

(1) The fixed capital cost of the replacements in comparison to the fixed capital cost that would be required to construct a comparable entirely new facility;

(2) The estimated life of the facility after the replacements compared to the life of a comparable entirely new facility;

(3) The extent to which the components being replaced cause or contribute to the emissions from the facility; and

(4) Any economic or technical limitations on compliance with applicable standards of performance which are inherent in the proposed replacements.

(g) Individual subparts of this part may include specific provisions which refine and delimit the concept of reconstruction set forth in this section.

6. Part 60 is amended by adding Appendix C as follows:

APPENDIX C—DETERMINATION OF EMISSION RATE CHANGE

1. *Introduction.*

1.1 The following method shall be used to determine whether a physical or operational change to an existing facility resulted in an increase in the emission rate to the atmosphere. The method used is the Student's *t* test, commonly used to make inferences from small samples.

2. *Data.*

2.1 Each emission test shall consist of *n* runs (usually three) which produce *n* emission rates. Thus two sets of emission rates are generated, one before and one after the change, the two sets being of equal size.

2.2 When using manual emission tests, except as provided in § 60.8(b) of this part, the reference methods of Appendix A to this part shall be used in accordance with the procedures specified in the applicable subpart both before and after the change to obtain the data.

2.3 When using continuous monitors, the facility shall be operated as if a manual emission test were being performed. Valid data using the averaging time which would be required if a manual emission test were being conducted shall be used.

3. *Procedure.*

3.1 Subscripts a and b denote prechange and postchange respectively.

3.2 Calculate the arithmetic mean emission rate, $\bar{E}$, for each set of data using Equation 1.

$$\bar{E}=\frac{\sum_{i=1}^{n} E_i}{n}=\frac{E_1+E_2\ldots+E_n}{n} \qquad (1)$$

where:

E_i = Emission rate for the *i* th run.

n = number of runs

3.3 Calculate the sample variance, S^2, for each set of data using Equation 2.

$$S^2=\frac{\sum_{i=1}^{n}(E_i-\bar{E})^2}{n-1}=\frac{\sum_{i=1}^{n}E_i^2-\left(\sum_{i=1}^{n}E_i\right)^2\Big/n}{n-1} \qquad (2)$$

3.4 Calculate the pooled estimate, S_p, using Equation 3.

$$S_p=\left[\frac{(n_a-1)\,S_a^2+(n_b-1)\,S_b^2}{n_a+n_b-2}\right]^{1/2} \qquad (3)$$

3.5 Calculate the test statistic, *t*, using Equation 4.

$$t=\frac{\bar{E}_b-\bar{E}_a}{S_p\left[\frac{1}{n_a}+\frac{1}{n_b}\right]^{1/2}} \qquad (4)$$

4. *Results.*

4.1 If $\bar{E}_b>\bar{E}_a$ and $t>t'$, where t' is the critical value of *t* obtained from Table 1, then with 95% confidence the difference between $\bar{E}_b$ and $\bar{E}_a$ is significant, and an increase in emission rate to the atmosphere has occurred.

TABLE 1

Degree of freedom (n_a+n_b-2):	*t′ (95 percent confidence level)*
2	2.920
3	2.353
4	2.132
5	2.015
6	1.943
7	1.895
8	1.860

For greater than 8 degrees of freedom, see any standard statistical handbook or text.

5.1 Assume the two performance tests produced the following set of data:

Test a:		Test b
Run 1.	100	115
Run 2.	95	120
Run 3.	110	125

5.2 Using Equation 1—

$$E_a=\frac{100+95+110}{3}=102$$

$$E_b=\frac{115+120+125}{3}=120$$

5.3 Using Equation 2—

$$S_a^2=\frac{(100-102)^2+(95-102)^2+(110-102)^2}{3-1}=58.5$$

$$S_b^2=\frac{(115-120)^2+(120-120)^2+(125-120)^2}{3-1}=25$$

5.4 Using Equation 3—

$$S_p=\left[\frac{(3-1)\,(58.5)+(3-1)\,(25)}{3+3-2}\right]^{1/2}=6.46$$

5.5 Using Equation 4—

$$t=\frac{120-102}{6.46\left[\frac{1}{3}+\frac{1}{3}\right]^{1/2}}=3.412$$

5.6 Since $(n_1+n_2-2)=4$, $t'=2.132$ (from Table 1). Thus since $t>t'$ the difference in the values of E_a and E_b is significant, and there has been an increase in emission rate to the atmosphere.

6. *Continuous Monitoring Data.*

6.1 Hourly averages from continuous monitoring devices, where available, should be used as data points and the above procedure followed.

(Secs. 111 and 114 of the Clean Air Act, as amended by sec. 4(a) of Pub. L. 91-604, 84 Stat 1678 (42 U.S.C. 1857c-6, 1857c-9))

[FR Doc.75-33612 Filed 12-15-75;8:45 am]

23 [FRL 471-6]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Emission Monitoring Requirements and Revisions to Performance Testing Methods; Correction

In FR Doc. 75-26565 appearing at page 46250 in the FEDERAL REGISTER of October 6, 1975, the following changes should be made in Appendix B:

1. On page 46260, paragraph 4.3, line 24 is corrected to read as follows:

$\log(1-O_1)=(l_1/l_2)\log(1-O_2)$

2. On page 46263, paragraph 4.1, line 8 is corrected to read as follows:

of an air preheater in a steam generating

3. On page 46269, paragraph 7.2.1, the definition of $C.I._m$ is corrected to read as follows:

$C.I._m$ = 95 percent confidence interval estimates of the average mean value.

Dated: December 16, 1975.

ROGER STRELOW,
Assistant Administrator for
Air and Waste Management.

[FR Doc.75-34614 Filed 12-19-75;8:45 am]

[FRL 423-7]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Emission Monitoring Requirements and Revisions to Performance Testing Methods

Correction

In FR Doc. 75-26565, appearing at page 46250 in the issue for Monday, October 6, 1975, the following changes should be made:

1. In the first paragraph on page 46250, the words "reduction, and reporting requirements" should be inserted immediately following the eighth line.

2. In the seventh from last line of the first full paragraph on page 46254, the parenthetical phrase should read, "October 6, 1975".

3. In the second line of the second full paragraph on page 46254, the next to last word, now reading "capacity", should read "opacity".

4. In paragraph (c)(2)(iii) of § 60.13 on page 46255, the parenthetical phrase "(date of promulgation" should read, "October 6, 1975".

5. In § 60.13, the paragraphs designated (g)(1) and (g)(1)(i) through (ix) on page 46256 should be designated paragraph (i) and (i) 1 through (9).

6. In the second line of the formula in paragraph (f)(4) of § 60.45 on page 46257, the figure now reading "6.34" should read "3.64".

7. The last line of the first paragraph in Appendix B on page 46259 should be changed to read "tinuous measurement of the opacity of stack emissions".

8. The paragraph now numbered "22" in Appendix B on page 46259 should be numbered "2.2".

9. In the next to last line of paragraphs 9.1.1 and 7.1.1 on pages 46261 and 46264 respectively "x" should read "x".

10. The first column in the table in paragraph 7.1.2 on page 46264, the first column should be headed by the letter "n" and figures 1 through 10 should read 2 through 11.

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24 SUBCHAPTER C—AIR PROGRAMS

[FRL 476-3]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCE

Delegation of Authority to State of Maine

Pursuant to the delegation of authority for the standards of performance for new stationary sources (NSPS) to the State of Maine on November 3, 1975, EPA is today amending 40 CFR 60.4, *Address*, to reflect this delegation. A Notice announcing this delegation is published today in the FEDERAL REGISTER.[1] The amended § 60.4, which adds the address of the Maine Department of Environmental Protection to which all reports, requests, applications, submittals, and communications to the Administrator pursuant to this part must also be addressed, is set forth below.

The Administrator finds good cause for foregoing prior public notice and for making this rulemaking effective immediately in that it is an administrative change and not one of substantive content. No additional substantive burdens are imposed on the parties affected. The delegation which is reflected by this administrative amendment was effective on October 7, 1975, and it serves no purpose to delay the technical change of this addition to the State address to the Code of Federal Regulations.

This rulemaking is effective immediately, and is issued under the authority of Section 111 of the Clean Air Act, as amended.

(42 U.S.C. 1857c-6)

Dated: December 22, 1975.

STANLEY W. LEGRO,
Assistant Administrator
for Enforcement.

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[1] See FR Doc. 75-35063 appearing elsewhere in the Notices section of today's FEDERAL REGISTER.

Part 60 of Chapter I, Title 40 of the Code of Federal Regulations is amended as follows:

1. In § 60.4 paragraph (b) is amended by revising subparagraph (U) to read as follows:

§ 60.4 Address.

* * * * *

(b) * * *

(U) State of Maine, Department of Environmental Protection, State House, Augusta, Maine 04330.

* * * * *

[FR Doc.75-35065 Filed 12-29-75;8:45 am]

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[FRL 477-7]

SUBCHAPTER C—AIR PROGRAMS

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Delegation of Authority to the State of Michigan

Pursuant to the delegation of authority to implement and enforce the standards of performace for new stationary sources (NSPS) to the State of Michigan on November 5, 1975, EPA is today amending 40 CFR 60.4 *Address*, to reflect this delegation.[1] The amended § 60.4, which adds the address of the Air Pollution Control Division, Michigan Department of Natural Resources to that list of addresses to which all reports, requests, applications, submittals, and communications to the Administrator pursuant to this part must be sent, is set forth below.

The Administrator finds good cause for foregoing prior public notice and for making this rulemaking effective immediately in that it is an administrative change and not one of substantive content. No additional substantive burdens are imposed on the parties affected. The delegation which is reflected by this administrative amendment was effective on November 5, 1975, and it serves no purpose to delay the technical change of this addition of the State address to the Code of Federal Regulations.

This rulemaking is effective immediately, and is issued under the authority of section 111 of the Clean Air Act, as amended. 42 U.S.C. 1857c-6.

Dated: December 31, 1975.

Stanley W. Legro,
Assistant Administrator for Enforcement.

Part 60 of Chapter I, Title 40 of the Code of Federal Regulation is amended as follows:

1. In § 60.4, paragraph (b) is amended by revising paragraph (b) X, to read as follows:

60.4 Address.

* * * * *

[FRL 447-8]

(b) * * *

(A)-(W) * * *

(X)—State of Michigan, Air Pollution Control Division, Michigan Department of Natural Resources, Stevens T. Mason Building, 8th Floor, Lansing, Michigan 48926

* * * * *

[FR Doc.76-847 Filed 1-12-76;8:45 am]

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[1] A Notice announcing this delegation is published in the Notices section of this issue.

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[FRL 462-7]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Coal Preparation Plants

On October 24, 1974 (39 FR 37922), under section 111 of the Clean Air Act, as amended, the Environmental Protection Agency (EPA) proposed standards of performance for new and modified coal preparation plants. Interested parties were afforded an opportunity to participate in the rulemaking by submitting written comments. Twenty-seven comment letters were received; six from coal companies, four from Federal agencies, four from steel companies, four from electric utility companies, three from State and local agencies, three from coal industry associations and three from other interested parties.

Copies of the comment letters and a supplemental volume of background information which contains a summary of the comments with EPA's responses are available for public inspection and copying at the U.S. Environmental Protection Agency, Public Information Reference Unit, Room 2922, 401 M Street, S.W., Washington, D.C. 20460. In addition, the supplemental volume of background information which contains copies of the comment summary with EPA's responses may be obtained upon written request from the EPA Public Information Center (PM-215), 401 M Street S.W., Washington, D.C. 20460 (specify Background Information for Standards of Performance: Coal Preparation Plants, Volume 3: Supplemental Information). The comments have been carefully considered, and where determined by the Administrator to be appropriate, changes have been made to the proposed regulations and are incorporated in the regulations promulgated herein.

The bases for the proposed standards are presented in "Background Information for Standards of Performance: Coal Preparation Plants" (EPA 450/2-74-021a, b). Copies of this document are available on request from the Emission Standards Protection Agency, Research Triangle and Engineering Division, Environmental Park, North Carolina 27711, Attention: Mr. Don R. Goodwin.

Summary of Regulation. The promulgated standards of performance regulate particulate matter emissions from coal preparation and handling facilities processing more than 200 tons/day of bituminous coal (regardless of their location) as follows: (1) emissions from thermal dryers may not exceed 0.070 g/dscm (0.031 gr/dscf) and 20% opacity, (2) emissions from pneumatic coal cleaning equipment may not exceed 0.040 g/dscm (0.018 gr/ dscf) and 10% opacity, and (3) emissions from coal handling and storage equipment (processing nonbituminous as well as bituminous coal) may not exceed 20% opacity.

Significant Comments and Revisions to the Proposed Regulations. Many of the comment letters received by EPA contained multiple comments. These are summarized as follows with discussions of any significant differences between the proposed and promulgated regulations.

1. *Applicability.*—Comments were received noting that the proposed standards would apply to any coal handling operation regardless of size and would require even small tipple operations and domestic coal distributors to comply with the proposed standards for fugitive emissions. In addition, underground mining activities may have been inadvertently included under the proposed standards. EPA did not intend to regulate either these small sources or underground mining activities. Only sources which break, crush, screen, clean, or dry large amounts of coal were intended to be covered. Sources which handle large amounts of coal would include coal handling operations at sources such as barge loading facilities, power plants, coke ovens, etc. as well as plants that primarily clean and/or dry coal. EPA concluded that sources not intended to be covered by the regulation handle less than 200 tons/day; therefore, the regulation promulgated herein exempts such sources.

Comments were received questioning the application of the standards to facilities processing nonbituminous coals (including lignite). As was stated in the preamble to the proposed regulation, it is intended for the standards to have broad applicability when appropriate. At the time the regulation was proposed, EPA considered the parameters relating to the control of emissions from thermal dryers to be sufficiently similar, whether bituminous or nonbituminous coal was being dried. Since the time of proposal, EPA has reconsidered the application of standards to the thermal drying of nonbituminous coal. It has concluded that such application is not prudent in the absence of specific data demonstrating the similarity of the drying characteristics and emission control characteristics to those of bituminous coal. There are currently very few thermal dryers or pneumatic air cleaners processing nonbituminous fuels. The facilities tested by EPA to demonstrate control equipment representative of best control technology were processing bituminous coal. Since the majority of the EPA test data and other information used to develop the standards are based upon bituminous coal processing, the particulate matter standards for thermal dryers and pneumatic coal cleaning equipment have been revised to apply only to those facilities processing bituminous coal.

The opacity standard for control of fugitive emissions is applicable to nonbituminous as well as bituminous coal since nonbituminous processing facilities will utilize similar equipment for transporting, screening, storing, and loading coal, and the control techniques applicable for minimizing fugitive particulate matter emissions will be the same regardless of the type of coal processed. Typically enclosures with some type of low energy collectors are utilized. The opacity of emissions can also be reduced by effectively covering or sealing the process from the atmosphere so that any avenues for escaping emissions are small. By minimizing the number and the dimensions of the openings through which fugitive emissions can escape, the opacity and the total mass rate of emissions can be reduced independently of the air pollution control devices. Also, water sprays have been demonstrated to be very effective for suppressing fugitive emissions and can be used to control even the most difficult fugitive emission problems. Therefore, the control of fugitive emissions at all facilities will be required since there are several control techniques that can be applied regardless of the type of coal processed.

2. *Thermal dryer standard.*—One commentator presented data and calculations which indicated that because of the large amount of fine particles in the coal his company processes, compliance with the proposed standard would require the application of a venturi scrubber with a pressure drop of 50 to 52 inches of water gage. The proposed standard was based on the application of a venturi scrubber with a pressure drop of 25 to 35 inches. EPA thoroughly evaluated this comment and concluded that the commentator's calculations and extrapolations could have represented the actual situation. Rather than revise the standard on the basis of the commentator's estimates, EPA decided to perform emission tests at a plant which processes the coal under question. The plant tested is controlled with a venturi scrubber and was operated at a pressure drop of 29 inches during the emission tests. These tests showed emissions of 0.080 to 0.134 g/dscm (0.035 to 0.058 gr/dscf). These results are numerically greater than the proposed standard; however, calculations indicate that if the pressure drop were increased from 29 inches to 41 inches, the proposed standard would be achieved. Supplemental information regarding estimates of emission control needed to achieve the mass standard is contained in Section II, Volume 3 of the supplemental background information document.

Since the cost analysis of the proposed standard was based on a venturi scrubber operating at 25 to 35 inches venturi pressure loss, the costs of operating at higher pressure losses were evaluated. These results indicated that the added cost of controlling pollutants to the level of the proposed standard is only 14 cents per ton of plant product even if a 50 inch pressure loss were used, and only five cents per ton in excess of the average control level required by state regulations in the major coal producing states. In comparison to the $18.95 per ton delivered price of U.S. coal in 1974 and even higher prices today, a maximum five cents per ton economic impact attributable to these regulations appears almost negligible. The total impact of 14 cents per ton for controlling particulate matter emissions can easily be passed along to the customer since the demand for thermal drying due to freight rate savings, the elimination of handling problems due to freezing, and the needs of the customer's process (coke ovens must control bulk density and power plants must control plugging of pulverizers) will remain unaffected by these regulations. Therefore, the economic impact of the standard upon thermal drying will not be large and the inflationary impact of the standard on the price of coal will be insignificant (one percent or less). From the standpoint of energy consumption, the power requirements of the air pollution control equipment are exponentially related to the control level such that a level of diminishing return is reached. Because the highest pressure loss that has been demonstrated by operation of a venturi scrubber on a coal dryer is 41 inches water gage, which is also the pressure loss estimated by a scrubber vendor to be needed to achieve the 70 mg/dscm standard, and because energy consumption increases dramatically at lower control levels (<70 mg/dscm), a particulate matter standard lower than 70 mg/dscm was not selected. At the 70 mg/dscm control level, the trade-off between control of emissions at the thermal dryer versus the increase in emissions at the power plant supplying the energy is favorable even though the mass quantity of all air pollutants emitted by the power plant (SO_x, NO_x, and particulate matter) are compared only to the reduction in thermal dryer particulate matter emissions. At lower than 70 mg/dscm, this trade-off is not as favorable due to the energy requirements of venturi scrubbers at higher pressure drops. For this source, alternative means of air pollution control have not been fully demonstrated. Having considered all comments on the particulate matter regulation proposed for thermal dryers, EPA finds no reason sufficient to alter the proposed standard of 70 mg/dscm except to restrict its applicability to thermal dryers processing bituminous coal.

3. *Location of thermal drying systems.*—Comments were received on the applicability of the standard for power plants with closed thermal drying systems where the air used to dry the coal is also used in the combustion process. As indicated in § 60.252(a), the standard is concerned only with effluents which are discharged into the atmosphere from the drying equipment. Since the pulverized coal transported by heated air is charged to the steam generator in a closed system, there is no discharge from the dryer directly to the atmosphere, therefore, these standards for thermal dryers are not applicable. Effluents from steam generators are regulated by standards previously promulgated (40 CFR Part 60 subpart D). However, these standards do apply to all bituminous coal drying operations that discharge effluent to the atmosphere regardless of their physical or geographical location. In additiona to thermal dryers located in coal preparation plants, usually in the vicinity of the mines, dryers used to preheat coal at coke ovens are alsoregulated by these standards. These coke oven thermal dryers used for preheating are similar in all respects, including the air pollution control equipment, to those used in coal preparation plants.

4. *Opacity standards.*—The opacity standards for thermal dryer and pneumatic coal cleaners were reevaluated as a result of revisions to Method 9 for conducting opacity observations (39 FR 39872). The opacity stndards were proposed prior to the revisions of Method 9 and were not based upon the concept of averaging sets of 24 observations for six-minute periods. As a result, the proposed standards were developed in relation to the peak emissions of the facility rather than the average emissions of six-minute periods. The opacity data collected by EPA have been reevaluated in accordance with the revised Method 9 procedures, and opacity standards for thermal dryers and pneumatic coal cleaners have been adjusted to levels consistent with these new procedures. The opacity standards for thermal dryers and pneumatic coal cleaners have been adjusted from 30 and 20 percent to 20 and 10 percent opacity, respectively. Since the proposed standards were based upon peak rather than average opacity, the revised standards are numerically lower. Each of these levels is justified based primarily upon six-minute averages of EPA opacity observations. These data are contained in Section III, Volume 3 of the supplemental background information document.

5. *Fugitive emission monitoring.*—Several commentators identified some difficulties with the proposed procedures for monitoring the surface moisture of thermally dried coal. The purpose of the proposed requirement was to determine the probability of fugitive emissions occuring from coal handling operations

and to estimate their extent. The commentators noted that the proposed A.S.T.M. measurement methods are difficult and cumbersome procedures not typically used by operating facilities. Also, it was noted that there is too little uniformity of techniques within industry for measuring surface moisture to specify a general method. Secondly, estimation of fugitive emissions from such data may not be consistent due to different coal characteristics. Since the opacity standard promulgated herein can readily be utilized by enforcement personnel, the moisture monitoring requirement is relatively unimportant. EPA has therefore eliminated this requirement from the regulation.

6. *Open storage piles.*—The proposed regulation applied the fugitive emission standard to coal storage systems, which were defined as any facility used to store coal. It was EPA's intention that this definition refer to some type of structure such as a bin, silo, etc. Several commentators objected to the potential application of the fugitive emission standard to open storage piles. Since the fugitive emission standard was not developed for application to open storage piles, the regulations promulgated herein clarifies that open storage piles of coal are not regulated by these standards.

7. *Thermal dryer monitoring equipment.*—A number of commentators felt that important variables were not being considered for monitoring venturi scrubber operation on thermal dryers. The proposed standards required monitoring the temperature of the gas from the thermal dryer and monitoring the venturi scrubber pressure loss. The promulgated standard requires, in addition to the above parameters, monitoring of the water supply pressure to the venturi scrubber. Direct measurement of the water flow rate was considered but rejected due to potential plugging problems as a result of solids typically found in recycled scrubber water. Also, the higher cost of a flow rate meter in comparison to a simpler pressure monitoring device was a factor in the selection of a water pressure monitor for verifying that the scrubber receives adequate water for proper operation. This revision to the regulations will insure monitoring of major air pollution control device parameters subject to variation which could go undetected and unnoticed and could grossly affect proper operation of the control equipment. A pressure sensor, two transmitters, and a two pen chart recorder for monitoring scrubber venturi pressure drop and water supply pressure, which are commercially available, will cost approximately two to three thousand dollars installed for each thermal dryer. This cost is only one-tenth of one percent of the total investment cost of a 500-ton-per-hour thermal dryer. The regulations also require monitoring of the thermal dryer exit temperature, but no added cost will result because this measurement system is normally supplied with the thermal drying equipment and is used as a control point for the process control system.

Effective date.—In accordance with section 111 of the Act, as amended, these regulations prescribing standards of performance for coal preparation plants are effective on January 15, 1976, and apply to thermal dryers, pneumatic coal cleaners, coal processing and conveying equipment, coal storage systems, and coal transfer and loading systems, the construction or modification of which was commenced after October 24, 1974.

Dated: January 8, 1976.

RUSSELL E. TRAIN,
Administrator.

Part 60 of Chapter I of Title 40 of the Code of Federal Regulations is amended as follows:

1. The table of contents is amended by adding subpart Y as follows:

* * * * *

Subpart Y—Standards of Performance for Coal Preparation Plants

Sec.
60.250 Applicability and designation of affected facility.
60.251 Definitions.
60.252 Standards for particulate matter.
60.253 Monitoring of operations.
60.254 Test methods and procedures.

AUTHORITY: Secs. 111 and 114 of the Clean Air Act, as amended by sec. 4(a) of Pub. L. 91-604, 84 Stat. 1678 (42 U.S.C. 1857c-6, 1857c-9).

2. Part 60 is amended by adding subpart Y as follows:

* * * * *

Subpart Y—Standards of Performance for Coal Preparation Plants

§ 60.250 Applicability and designation of affected facility.

The provisions of this subpart are applicable to any of the following affected facilities in coal preparation plants which process more than 200 tons per day: thermal dryers, pneumatic coal-cleaning equipment (air tables), coal processing and conveying equipment (including breakers and crushers), coal storage systems, and coal transfer and loading systems.

§ 60.251 Definitions.

As used in this subpart, all terms not defined herein have the meaning given them in the Act and in subpart A of this part.

(a) "Coal preparation plant" means any facility (excluding underground mining operations) which prepares coal by one or more of the following processes: breaking, crushing, screening, wet or dry cleaning, and thermal drying.

(b) "Bituminous coal" means solid fossil fuel classified as bituminous coal by A.S.T.M. Designation D-388-66.

(c) "Coal" means all solid fossil fuels classified as anthracite, bituminous, subbituminous, or lignite by A.S.T.M. Designation D-388-66.

(d) "Cyclonic flow" means a spiraling movement of exhaust gases within a duct or stack.

(e) "Thermal dryer" means any facility in which the moisture content of bituminous coal is reduced by contact with a heated gas stream which is exhausted to the atmosphere.

(f) "Pneumatic coal-cleaning equipment" means any facility which classifies bituminous coal by size or separates bituminous coal from refuse by application of air stream(s).

(g) "Coal processing and conveying equipment" means any machinery used to reduce the size of coal or to separate coal from refuse, and the equipment used to convey coal to or remove coal and refuse from the machinery. This includes, but is not limited to, breakers, crushers, screens, and conveyor belts.

(h) "Coal storage system" means any facility used to store coal except for open storage piles.

(i) "Transfer and loading system" means any facility used to transfer and load coal for shipment.

§ 60.252 Standards for particulate matter.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, an owner or operator subject to the provisions of this subpart shall not cause to be discharged into the atmosphere from any thermal dryer gases which:

(1) Contain particulate matter in excess of 0.070 g/dscm (0.031 gr/dscf).

(2) Exhibit 20 percent opacity or greater.

(b) On and after the date on which the performance test required to be conducted by § 60.8 is completed, an owner or operator subject to the provisions of this subpart shall not cause to be discharged into the atmosphere from any pneumatic coal cleaning equipment, gases which:

(1) Contain particulate matter in excess of 0.040 g/dscm (0.018 gr/dscf).

(2) Exhibit 10 percent opacity or greater.

(c) On and after the date on which the performance test required to be conducted by § 60.8 is completed, an owner or operator subject to the provisions of this subpart shall not cause to be discharged into the atmosphere from any coal processing and conveying equipment, coal storage system, or coal transfer and loading system processing coal, gases which exhibit 20 percent opacity or greater.

§ 60.253 Monitoring of operations.

(a) The owner or operator of any thermal dryer shall install, calibrate, maintain, and continuously operate monitoring devices as follows:

(1) A monitoring device for the measurement of the temperature of the gas stream at the exit of the thermal dryer on a continuous basis. The monitoring device is to be certified by the manufacturer to be accurate within ±3° Fahrenheit.

(2) For affected facilities that use venturi scrubber emission control equipment:

(i) A monitoring device for the continuous measurement of the pressure loss through the venturi constriction of the control equipment. The monitoring device is to be certified by the manufacturer to be accurate within ±1 inch water gage.

(ii) A monitoring device for the continuous measurement of the water supply pressure to the control equipment. The monitoring device is to be certified by the manufacturer to be accurate within ±5 percent of design water supply pressure. The pressure sensor or tap must be located close to the water discharge point. The Administrator may be consulted for approval of alternative locations.

(b) All monitoring devices under paragraph (a) of this section are to be recalibrated annually in accordance with procedures under § 60.13(b)(3) of this part.

§ 60.254 Test methods and procedures.

(a) The reference methods in Appendix A of this part, except as provided in § 60.8(b), are used to determine compliance with the standards prescribed in § 60.252 as follows:

(1) Method 5 for the concentration of particulate matter and associated moisture content,

(2) Method 1 for sample and velocity traverses,

(3) Method 2 for velocity and volumetric flow rate, and

(4) Method 3 for gas analysis.

(b) For Method 5, the sampling time for each run is at least 60 minutes and the minimum sample volume is 0.85 dscm (30 dscf) except that shorter sampling times or smaller volumes, when necessitated by process variables or other factors, may be approved by the Administrator. Sampling is not to be started until 30 minutes after start-up and is to be terminated before shutdown procedures commence. The owner or operator of the affected facility shall eliminate cyclonic flow during performance tests in a manner acceptable to the Administrator.

(c) The owner or operator shall construct the facility so that particulate emissions from thermal dryers or pneumatic coal cleaning equipment can be accurately determined by applicable test methods and procedures under paragraph (a) of this section.

[FR Doc.76-1240 Filed 1-14-76;8:45 am]

Title 40—Protection of Environment

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

SUBCHAPTER C—AIR PROGRAMS

[FRL 452-3]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Primary Copper, Zinc, and Lead Smelters

On October 16, 1974 (39 FR 37040), pursuant to section 111 of the Clean Air Act, as amended, the Administrator proposed standards of performance for new and modified sources within three categories of stationary sources: (1) primary copper smelters, (2) primary zinc smelters, and (3) primary lead smelters. The Administrator also proposed amendments to Appendix A, Reference Methods, of 40 CFR Part 60.

Interested persons representing industry, trade associations, environmental groups, and Federal and State governments participated in the rulemaking by sending comments to the Agency. Commentators submitted 14 letters containing eighty-five comments. Each of these comments has been carefully considered and where determined by the Administrator to be appropriate, changes have been made to the proposed regulations which are promulgated herein.

The comment letters received, a summary of the comments contained in these letters, and the Agency's responses to these comments are available for public inspection at the Freedom of Information Center, Room 202 West Tower, 401 M Street, S.W., Washington, D.C. Copies of the comment summary and the Agency's responses may be obtained by writing to the EPA Public Information Center (PM-215), 401 M Street, S.W., Washington, D.C. 20460, and requesting the Public Comment Summary—Primary Copper, Zinc and Lead Smelters.

The bases for the proposed standards are presented in "Background Information for New Source Performance Standards: Primary Copper, Zinc and Lead Smelters, Volume 1, Proposed Standards" (EPA-450/2-74-002a) and "Economic Impact of New Source Performance Standards on the Primary Copper Industry: An Assessment" (EPA Contract No. 68-02-1349—Task 2). Copies of these documents are available on request from the Emission Standards and Engineering Division, Environmental Protection Agency, Research Triangle Park, North Carolina 27711, Attention: Mr. Don R. Goodwin.

SUMMARY OF REGULATIONS

The promulgated standards of performance for new and modified primary copper smelters limit emissions of particulate matter contained in the gases discharged into the atmosphere from dryers to 50 mg/dscm (0.022 gr/dscf). In addition, the opacity of these gases is limited to 20 percent.

Emissions of sulfur dioxide contained in the gases discharged into the atmosphere from roasters, smelting furnaces and copper converters are limited to 0.065 percent by volume (650 parts per million) averaged over a six-hour period. Reverberatory smelting furnaces at primary copper smelters which process an average smelter charge containing a high level of volatile impurities, however, are exempt from this standard during those periods when such a charge is processed. A high level of volatile impurities is defined to be more than 0.2 weight percent arsenic, 0.1 weight percent antimony, 4.5 weight percent lead or 5.5 weight percent zinc. In addition, where a sulfuric acid plant is used to comply with this standard, the opacity of the gases discharged into the atmosphere is limited to 20 percent.

The regulations also require any primary copper smelter that makes use of the exemption provided for reverberatory smelting furnaces processing a charge of high volatile impurity content to keep a monthly record of the weight percent of arsenic, antimony, lead and zinc contained in this charge. In addition, the regulations require continuous monitoring systems to monitor and record the opacity of emissions discharged into the atmosphere from any dryer subject to the standards and the concentration of sulfur dioxide in the gases discharged into the atmosphere from any roaster, smelting furnace, or copper converter subject to the standard. While these regulations pertain primarily to sulfur dioxide emissions, the Agency recognizes the potential problems posed by arsenic emissions and is conducting studies to assess these problems. Appropriate action will be taken at the conclusion of these studies.

The promulgated standards of performance for new and modified primary zinc smelters limit emissions of particulate matter contained in the gases discharged into the atmosphere from sintering machines to 50 mg/dscm (0.022 gr/dscf). The opacity of these gases is limited to 20 percent.

Emissions of sulfur dioxide contained in the gases discharged into the atmosphere from roasters and from any sintering machine which eliminates more than 10 percent of the sulfur initially contained in the zinc sulfide concentrates processed are limited to 0.065 percent by volume (650 parts per million) averaged over a two-hour period. In addition, where a sulfuric acid plant is used to comply with this standard, the opacity of the gases discharged into the atmosphere is limited to 20 percent.

The regulations also require continuous monitoring systems to monitor and record the opacity of emissions discharged into the atmosphere from any sintering machine subject to the standards, and the concentration of sulfur dioxide in the gases discharged into the atmosphere from any roasters or sintering machine subject to the standard limiting emissions of sulfur dioxide.

The promulgated standards of performance for new and modified primary lead smelters limit emissions of particulate matter contained in the gases discharged into the atmosphere from blast furnaces, dross reverberatory furnaces and sintering machine discharge ends to 50 mg/dscm (0.022 gr/dscf). The opacity of these gases is limited to 20 percent.

Emissions of sulfur dioxide contained in the gases discharged into the atmosphere from sintering machines, electric smelting furnaces and converters are limited to 0.065 percent by volume (650 parts per million) averaged over a two-hour period. Where a sulfuric acid plant is used to comply with this standard, the opacity of the gases discharged into the atmosphere is limited to 20 percent.

The regulations also require continuous monitoring systems to monitor and record the opacity of emissions discharged into the atmosphere from any blast furnace, dross reverberatory furnace, or sintering machine discharge end subject to the standards, and the concentration of sulfur dioxide in the gases discharged into the atmosphere from any sintering machine, electric furnace or converter subject to the standards.

MAJOR COMMENTS AND CHANGES MADE TO THE PROPOSED STANDARDS

PRIMARY COPPER SMELTERS

Most of the comments submitted to the Agency concerned the proposed standards of performance for primary copper smelters. As noted in the preamble to the proposed standards, the domestic copper smelting industry expressed strong objections to these standards during their development. Most of the comments submitted by the industry following proposal of these standards reiterated these objections. In addition, a number of comments were submitted by State agencies, environmental organizations and private individuals, also expressing objections to various aspects of the proposed standards. Consequently, it is appropriate to review the basis of the proposed standards before discussing the comments received, the responses to these comments and the changes made to the standards for promulgation.

The proposed standards would have limited the concentration of sulfur dioxide contained in gases discharged into the atmosphere from all new and modified roasters; reverberatory, flash and electric smelting furnaces; and copper converters at primary copper smelters to 650 parts per million. Uncontrolled roasters, flash and electric smelting furnaces and copper converters discharge gas streams containing more than 3½ percent sulfur dioxide. The cost of controlling these gas streams with sulfuric acid plants was considered reasonable. Reverberatory smelting furnaces, however, normally discharge gas streams containing less than 3½ percent sulfur dioxide, and the cost of controlling these gas streams through the use of various sulfur dioxide scrubbing systems currently available was considered unreasonable in most cases. It was the Administrator's conclusion, however, that flash and electric smelting considered together were applicable to essentially the full range of domestic primary copper smelting operations. Consequently, standards were proposed which applied equally to new flash, electric and reverberatory smelting furnaces. The result was standards which favored construction of new flash and electric smelting furnaces over new reverberatory smelting furnaces.

Most of the increase in copper production over the next few years will probably result from expansion of existing copper smelters. Of the sixteen domestic primary copper smelters, only one employs flash smelting and only two employ electric smelting. The remaining thirteen employ reverberatory smelting, although one of these thirteen has initiated construction to convert to electric smelting and another has initiated construction to convert to a new smelting process referred to as Noranda smelting. (The Noranda smelting process discharges a gas stream of high sulfur dioxide concentration which is easily controlled at reasonable costs. By virtue of the definition of a smelting furnace, the promulgated standards also apply to Noranda furnaces.)

In view of the Administrator's judgment that the cost of controlling sulfur dioxide emissions from reverberatory furnaces was unreasonable, the Administrator concluded that an exemption from the standards was necessary for existing reverberatory smelting furnaces, to permit expansion of existing smelters at reasonable costs. Consequently, the proposed standards stated that any physical changes or changes in the method of operation of existing reverberatory smelting furnaces, which resulted in an increase in sulfur dioxide emissions from these furnaces, would not cause these furnaces to be considered "modified" affected facilities subject to the standards. This exemption, however, applied only where total emissions of sulfur dioxide from the primary copper smelter in question did not increase.

Prior to the proposal of these standards, the Administrator commissioned the Arthur D. Little Co., Inc., to undertake an independent assessment of both the technical basis for the standards and the potential impact of the standards on the domestic primary copper smelting industry. The results of this study have been considered together with the comments submitted during the public review and comment period in determining whether the proposed standards should be revised for promulgation.

Briefly, the Arthur D. Little study reached the following conclusions:

(1) The proposed standards should have no adverse impact on new primary copper smelters processing materials containing low levels of volatile impurities.

(2) The proposed standards could reduce the capability of new primary copper smelters located in the southwest U.S. to process materials of high impurity content. This impact was foreseen since the capability of flash smelting to process materials of high impurity levels was unknown. Although electric smelting was considered technically capable of processing these materials, the higher costs associated with electric smelting, due to the high cost of electrical power in the southwest, were considered sufficient to preclude its use in most cases.

This conclusion was subject, however, to qualification. It applied only to the southwest (Arizona, New Mexico and west Texas) and not to other areas of the United States (Montana, Nevada, Utah and Washington) where primary copper smelters currently operate; and it was not viewed as applicable to large new ore deposits of high impurity content which were capable of providing the entire charge to a new smelter. The study also concluded it was impossible to estimate the magnitude of this potential impact since it was not possible to predict impurity levels likely to be produced from new ore reserves.

Although considerable doubt existed as to the need for a new smelter in the southwest to process materials of high impurity levels in the future (essentially all the information and data examined indicated such a need is not likely to arise), the Arthur D. Little study concluded it would be prudent to assume new smelters in the southwest should have the flexibility to process these materials. To assume otherwise according to the study might place constraints on possible future plans of the American Smelting and Refining Company.

(3) The proposed standards should have little or no impact on the ability of existing primary copper smelters to expand copper production. This conclusion was also subject to qualification. It was noted that other means of expanding smelter capacity might exist than the approaches studied and that the proposed standards might or might not influence the viability of these other means of expanding capacity. It was also noted that the study assumed existing single absorption sulfuric acid plants could be converted to double absorption, but that individual smelters were not visited and this conversion might not be possible at some smelters.

Each of the comment letters received by EPA contained multiple comments. The most significant comments, the Agency's responses to these comments and the various changes made to the proposed regulations for promulgation in response to these comments are discussed below.

(1) *Legal authority under section 111.* Four commentators indicated that the Agency would exceed its statutory authority under section 111 of the Act by promulgating a standard of performance that could not be met by copper reverberatory smelting furnaces, which are extensively used at existing domestic smelters. The commentators believe that the "best system of emission reduction" cited in section 111 refers to control techniques that reduce emissions, and not to processes that emit more easily controlled effluent gas streams. The commentators contend, therefore, that a producer may choose the process that is most appropriate in his view, and new source performance standards must be based on the application of the best demonstrated techniques of emission reduction to that process.

The legislative history of the 1970 Amendments to the Act is cited by these commentators as supporting this interpretation of section 111. Specifically pointed out is the fact that the House-Senate Conference Committee, which reconciled competing House and Senate versions of the bill, deleted language from the Senate bill that would have granted the Agency explicit authority to regulate processes. This action, according to these commentators, clearly indicates a Congressional intent not to grant the Agency such authority.

The conference bill, however, merely replaced the phrase in the Senate bill "latest available control technology, processes, operating method or other alternatives" with "best system of emission reduction which (taking into account the cost of achieving such reduction) the Administrator determines has been adequately demonstrated." The use of the phrase "best system of emission reduction" appears to be inclusive of the terms in the Senate bill. The absence of discussion in the conference report on this issue further suggests that no substantive change was intended by the substitution of the phrase "best system of emission reduction" for the phrase "latest available control technology, processes, operating method or other alternatives" in the Senate bill.

For some classes of sources, the different processes used in the production activity significantly affect the emission levels of the source and/or the technology that can be applied to control the source. For this reason, the Agency believes that the "best system of emission reduction" includes the processes utilized and does not refer only to emission control hardware. It is clear that adherence to existing process utilization could serve to undermine the purpose of section 111 to require maximum feasible control of new sources. In general, therefore, the Agency believes that section 111 authorizes the promulgation of one standard applicable to all processes used by a class of sources, in order that the standard may reflect the maximum feasible control for that class. When the application of a standard to a given process would effectively ban the process, however, a separate standard must be prescribed for it unless some other process(es) is available to perform the function at reasonable cost.

In determining whether the use of different processes would necessitate the setting of different standards, the Agency first determines whether or not the processes are functionally interchangeable Factors such as whether the least polluting process can be used in various locations or with various raw materials or under other conditions are considered The second important consideration of the Agency involves the costs of achieving the reduction called for by a standard applicable to all processes used in a source category. Where a single standard would effectively preclude using a process which is much less expensive than the permitted process, the economic impact of the single standard must be determined to be reasonable or separate standards are set. This does not mean however, that the cost of the alternatives to the potentially prohibited process can be no grater than those which would be associated with controlling the process under a less stringent standard.

The Administrator has determined that the flash copper smelting process is available and will perform the function of the reverberatory copper smelting process at reasonable cost, except that flash smelting has not yet been commercially demonstrated for the processing of feed materials with a high level of volatile impurities. The standards promulgated herein, which do not apply to copper reverberatory smelting furnaces when the smelter charge contains a high level of volatile impurities, are therefore authorized under section 111 of the Act.

(2) *Control of reverberatory smelting furnaces.* Two commentators representing environmental groups and one commentator representing a State pollution control agency questioned the Administrator's judgment that the use of various sulfur dioxide scrubbing systems to control sulfur dioxide emissions from reverberatory smelting furnaces was unreasonable, especially in view of his conclusion that the use of these systems on large steam generators was reasonable. These commentators also pointed out that this conclusion was based only on an examination of the use of sulfur dioxide scrubbing systems and that alternative means of control, such as the use of oxygen enrichment of reverberatory furnace combustion air, or the mixing of the gases from the reverberatory furnace with the gases from roasters and copper converters to produce a mixed gas stream suitable for control, were not examined.

This comment was submitted in response to the exemption included in the proposed standards for existing reverberatory smelting furnaces. As discussed below, the amendments recently promulgated by the Agency to 40 CFR Part 60 clarifying the meaning of "modification" make this exemption unnecessary. The comment is still appropriate, however, since the promulgated standards now include an exemption for new reverberatory smelting furnaces at smelters processing materials containing high levels of volatile impurities.

Section 111 of the Clean Air Act dictates that standards of performance be based on "* * * the best system of emission reduction which (taking into account the cost of achieving such reduction) the Administrator determines has been adequately demonstrated." Thus, not only must various systems of emission control be investigated to ensure these systems are technically proven and the levels to which emissions could be reduced through the use of these systems identified, the costs of these systems must be considered to ensure that standards of performance will not impose an unreasonable economic burden on each source category for which standards are developed.

The control of gas streams containing low concentrations of sulfur dioxide through the use of various scrubbing systems which are currently available is considered by the Administrator to be technically proven and well demonstrated. The use of these systems on large steam generators is considered reasonable since electric utilities are regulated monopolies and the costs incurred to control sulfur dioxide emissions can be passed forward to the consumer. Primary copper smelters, however, do not enjoy a monopolistic position and face direct competition from both foreign smelters and other domestic smelters. The costs associated with the use of these scrubbing systems on reverberatory smelting furnaces at primary copper smelters are so large, in the Administrator's judgment, that they could not be either absorbed by a copper smelter without resulting in a significant decrease in profitability, passed forward to the consumer without leading to a significant loss in sales, or passed back to the mining operations without resulting in a closing of some mines and a decrease in mining activity. Consequently, the Administrator considers the use of these systems to control reverberatory smelting furnaces unreasonable.

Although little discussion is included in the background document supporting the proposed standards concerning the use of oxygen enrichment of reverberatory furnace combustion air, or the mixing of the gases from reverberatory furnaces with the gases from roasters and copper converters, these approaches for controlling sulfur dioxide emissions from reverberatory smelting furnaces were examined. These investigations, however, were not of an in-depth nature and were not pursued to completion.

A preliminary analysis of oxygen enrichment of reverberatory furnace combustion air to produce a strong gas stream from the reverberatory furnace appeared to indicate that the costs associated with this approach were unreasonable. A similar analysis of the mixing of the gases from a reverberatory furnace with the gases discharged from a fluid-bed roaster and copper converters appeared to indicate that although the costs associated with this approach were reasonable, it was not possible to use fluid-bed roasters in all cases. Multi-hearth roasters would be required where materials of high volatile impurity levels were processed. Although multi-hearth roasters discharge strong gas streams (4–5 percent sulfur dioxide), fluid bed roasters discharge much stronger gas streams (10–12 percent sulfur dioxide). To determine the effect of this lower concentration of sulfur dioxide in the gases discharged by multi-hearth roasters on the ability to mix the gases discharged by reverberatory smelting furnaces with those discharged by roasters and copper converters to produce a mixed gas stream suitable for control at reasonable costs would have required further investigation and study.

Unfortunately, limited resources prevented all avenues of investigation from being pursued and in view of the promising indications from the preliminary investigations into flash and electric smelting, the Agency concentrated its efforts in this area. As discussed below, however, the use of these approaches to control sulfur dioxide emissions from reverberatory smelting furnaces are under investigation as a means by which the promulgated standards of performance could be extended to cover reverberatory smelting furnaces which process materials containing high levels of impurities.

(3) *Materials of high impurity levels.* One commentator expressed his belief that the proposed standards would prevent new primary copper smelters from processing materials containing high levels of impurities, such as arsenic, antimony, lead and zinc. This commentator does not feel flash smelting can be considered demonstrated for smelting materials containing these impurities. The commentator also feels the domestic smelting industry will not be able to employ electric smelting to process materials of this nature in the future, since electric power will not be available, or only available at a price which will prevent its use by the industry.

At the time of proposal of the standards for primary copper smelters, the Administrator was aware that considerable doubt existed concerning the capability of flash smelting to process materials of high impurity levels. No doubt existed, however, with regard to the capability of electric smelting to process these materials. Consequently, the standards were proposed on the basis that where flash smelting could not be employed to process those materials, electric smelting could.

As outlined above, the Arthur D. Little study concluded that at no flash smelter in the world has the average composition of the total charge processed on a routine basis exceeded 0.2 weight percent arsenic, 0.1 weight percent antimony, 4.5 weight percent lead and 5.5 weight percent zinc. Thus, the capability of flash smelting to process a charge containing higher levels of impurities than these has not been adequately demonstrated. At this time, therefore, only electric smelting preceded by multi-hearth roasting (in addition to reverberatory smelting preceded by multi-hearth roasting) can be considered adequately demonstrated (excluding costs) for processing these materials.

The Arthur D. Little study also examined the projected availability and pricing of various forms of energy through 1980 for those areas of the United States where primary copper smelters now operate. Although the energy consumed by electric smelting is approximately equal to that consumed by reverberatory smelting (taking into account the energy inefficiency associated with electric power generation), the study concluded that a cost penalty of 1 to 2 cents per pound of copper is associated with electric smelting in the southwest U.S. due to the high cost of electric power in this region. This cost penalty was considered sufficient in the Arthur D. Little study to make the use of electric smelting at new primary copper smelters located in the southwest economically unattractive in most cases.

Since the basis for the proposed standards considered electric smelting as a viable alternative should flash smelting prove unable to process materials of high impurity levels, the Administrator has concluded the proposed standards should be revised for promulgation. Consequently, the standards promulgated herein exempt new reverberatory smelting furnaces at primary copper smelters which process a total charge containing more than 0.2 weight percent arsenic, 0.1 weight percent antimony, 4.5 weight percent lead or 5.5 weight percent zinc. This will permit new primary copper smelters to be constructed to process materials of high impurity levels without employing electric smelting. The promulgated standards of performance will, however, apply to new roasters and copper converters at these smelters, since the Administrator has concluded these facilities can be operated to produce gas streams containing greater than 3½ percent sulfur dioxide and that the costs associated with controlling these gas streams are reasonable.

Although the Administrator considers it prudent to promulgate the standards with this exemption for new reverberatory smelting furnaces, the Administrator believes this exemption may not be necessary. As pointed out in the comments submitted by various environmental organizations and private citizens, neither the use of oxygen enrichment of reverberatory furnace combustion air, nor the mixing of the gases from reverberatory furnaces with those from multi-hearth roasters and copper converters were investigated in depth by the Agency in developing the proposed standards. Either of these approaches could prove to be reasonable for controlling sulfur dioxide emissions from reverberatory smelting furnaces.

Under the promulgated standards with the exemptions provided for new reverberatory smelting furnaces, new primary copper smelters could remain among the largest point sources of sulfur dioxide emissions within the U.S. Consequently, the Agency's program to develop standards of performance to limit sulfur dioxide emissions from primary copper smelters will continue. This program will focus on the use of oxygen enrichment of reverberatory furnace combustion air and the mixing of the gases from reverberatory smelting furnaces with those from multi-hearth roasters and copper converters. If the Administrator concludes either or both of these approaches can be employed to control sulfur dioxide emissions from reverberatory smelting furnaces at reasonable costs, the Administrator will propose that this exemption be deleted.

(4) *Copper smelter modifications*. One of the major issues associated with the proposed regulations on modification, notification and reconstruction (39 FR 36946) involved the "bubble concept." The "bubble concept" refers to the trading off of emission increases from one existing facility undergoing a physical or operational change at a source with emission reductions from another existing facility at the same source. If there is no net increase in the amount of any air pollutant (to which a standard applies) emitted into the atmosphere by the source as a whole, the facility which experienced an emissions increase is not considered modified. Although the "bubble concept" may be applied to existing facilities which undergo a physical or operational change, it may not be applied to cover construction of new facilities.

In commenting on the proposed standards of performance for primary copper smelters, two commentators suggested that the bubble concept be extended to include construction of new facilities at existing copper smelters. These commentators indicated that this could result in a substantial reduction in the costs, while at the same time leading to a substantial reduction in emissions from the smelter.

To support their claims, these commentators presented two hypothetical examples of expansions at a copper smelter that could occur through construction of new facilities. Where new facilities were controlled to meet standards of performance, emissions from the smelter as a whole increased. Where some new facilities were not controlled to meet standards of performance, emissions from the smelter as a whole decreased substantially.

These results, however, depend on special manipulation of emissions from the existing facilities at the smelter. In the case where new facilities are controlled to meet standards of performance, emissions from existing facilities are not reduced. Thus, with construction of new facilities, emissions from the smelter as a whole increase. In the case where some new facilities are not controlled to meet standards of performance, emissions from existing facilities are reduced through additional emission control or production cut-back. Since emissions from the existing facilities were assumed to be very large initially, a reduction in these emissions results in a net reduction in emissions from the smelter as a whole.

These hypothetical examples, however, appear to represent contrived situations. In many cases, compliance with State implementation plans to meet the National Ambient Air Quality Standards will require existing copper smelters to control emissions to such a degree that the situations portrayed in the examples presented by these commentators are not likely to arise. Furthermore, a smelter operator may petition the Administrator for reconsideration of the promulgated standards if he believes they would be infeasible when applied to his smelter.

Another commentator asked whether conversion of an existing reverberatory smelting furnace from firing natural gas to firing coal would constitute a modification. This commentator pointed out that although the conversion to firing coal would increase sulfur dioxide emissions from the smelter by 2 to 3 percent, the costs of controlling the furnace to meet the standards of performance would be prohibitive.

The primary objective of the promulgated standards is to control emissions of sulfur dioxide from the copper smelting process. The data and information supporting the standards consider essentially only those emissions arising from the basic smelting process, not those arising from fuel combustion. It is not the direct intent of these standards, therefore, to control emissions from fuel combustion per se. Consequently, since emissions from fuel combustion are negligible in comparison with those from the basic smelting process, and a conversion of reverberatory smelting furnaces to firing coal rather than natural gas will aid in efforts to conserve natural gas resources, the standards promulgated herein include a provision exempting fuel switching in reverberatory smelting furnaces from consideration as a modification.

(5) *Expansion of existing smelters*. Two commentators expressed their concern that the proposed standards would prevent the expansion of existing primary copper smelters, since the standards apply to modified facilities as well as new facilities. These commentators reasoned that the costs associated with controlling emissions from each roaster, smelting furnace or copper converter modified during expansion would in many cases make these expansions economically unattractive.

As noted above, the Agency has proposed amendments to the general provisions of 40 CFR Part 60 covering modified and reconstructed sources. Under these provisions, standards of performance apply only where an existing facility at a source is reconstructed; where a change in an existing facility results in an increase in the total emissions at a source; and where a new facility is constructed at a source. Thus, unless total emissions from a primary copper smelter increase, most alterations to existing roasters, smelting furnaces or copper converters which increase their emissions will not cause these facilities to be considered modified and subject to standards of performance.

The Administrator does not believe the standards promulgated herein will deter expansion of existing primary copper smelters. As discussed earlier, the Administrator concluded at proposal that the cost of controlling reverberatory smelting furnaces was unreasonable (through the use of various sulfur dioxide scrubbing systems currently available), and for this reason included an exemption in the proposed standards for existing reverberatory smelting furnaces. The prime objective of this exemption was to ensure that existing primary copper smelters could expand copper production at reasonable costs.

Also, as discussed earlier, the Arthur D. Little study examined this aspect of the proposed standards and concluded the standards would have little or no impact on the ability of existing primary copper smelters to expand production.

This conclusion was subject to two qualifications: other means of expanding smelter capacity might exist than those examined and the impact of the proposed standards on these means of expanding capacity is unknown; and it was assumed that existing single absorption sulfuric acid plants could be converted to double absorption, but at some smelters this might not be possible.

The Administrator does not feel these qualifications seriously detract from the essential conclusion that the standards are likely to have little impact on the expansion capabilities of existing copper smelters. The various means of expanding smelter capacity examined in the Arthur D. Little study represent commonly employed techniques for increasing copper production from as little as 10 to 20 percent, to as much as 50 percent at existing smelters. Consequently, the Administrator considers the approaches examined in the study as broadly representative of various means of expanding existing primary copper smelters and as a reasonable basis from which conclusions regarding the potential impact of the standards on the expansion capabilities of the domestic primary copper smelting industry can be drawn.

The Administrator views the assumption in the Arthur D. Little report that existing single absorption sulfuric acid plants can be converted to double absorption as a good assumption. Although at some existing primary copper smelters the physical plant layout might complicate a conversion from single absorption to double absorption, the remote isolated location of most smelters provides ample space for the construction of additional plant facilities. Thus, while the costs for conversion may vary from smelter to smelter, it is unlikely that at any smelter a conversion could not be made.

As proposed, provisions were included in the regulations specifically stating that physical and operating changes to existing reverberatory smelting furnaces which resulted in an increase in sulfur dioxide emissions would not be considered modifications, provided total emissions of sulfur dioxide from the copper smelter did not increase above levels specified in State implementation plans.

Since proposal of the standards, amendments to 40 CFR Part 60 to clarify the meaning of modification under section 111 have been proposed. These amendments permit changes to existing facilities within a source which increase emissions from these facilities without requiring compliance with standards of performance, provided total emissions from the source do not increase. Since this was the objective of the provisions included in the proposed regulations for primary copper smelters with regard to changes to existing reverberatory smelting furnaces, these provisions are no longer necessary and have been deleted from the promulgated regulations.

(6) *Increased energy consumption.* Two commentators indicated that the Agency's estimate of the impact of the standards of performance for primary copper, zinc and lead smelters on energy consumption was much too low. Since the number of smelters which will be affected by the standards is relatively small, the Agency has developed a scenario on a smelter-by-smelter basis, by which the domestic industry could increase copper production by 400,000 tons by 1980. This increase in copper production represents a growth rate of about 3.5 percent per year and is consistent with historical industry growth rates of 3 to 4 percent per year.

On this new basis, the energy required to control all new primary copper, zinc and lead smelters constructed by 1980 to comply with both the proposed standards and the standards promulgated herein is the same and is estimated to be 320 million kilowatt-hours per year. This is equivalent to about 520,000 barrels of number 6 fuel oil per year. Relative to typical State implementation plan requirements for primary copper, zinc and lead smelters, the incremental energy required by these standards is 50 million kilowatt-hours per year, which is equivalent to about 80,000 barrels of number 6 fuel oil per year.

The energy required to comply with the promulgated standards at these new smelters by 1980 represents no more than approximately 3.5 percent of the process energy which would be required to operate these smelters in the absence of any control of sulfur dioxide emissions. The incremental amount of energy required to meet these standards is somewhat less than 0.5 percent of the total energy (process plus air pollution) which would be required to operate these new smelters and meet typical State implementation plan emission control requirements.

One commentator stated the Agency's initial estimate of the increased energy requirements associated with the proposed standards was low because the Agency did not take into account a 3 million Btu per ton of copper concentrate energy debit, attributed by the commentator to electric smelting compared to reverberatory smelting. The new basis used by the Agency to estimate the impact of the standards on energy consumption anticipates no new electric smelting by 1980. Consequently, any difference in the energy consumed by electric smelting compared to reverberatory smelting will have no impact on the amount of energy required to comply with the standards.

The Agency's estimates of the energy requirements associated with electric smelting and reverberatory smelting, which are included in the background information for the proposed standards, are based on a review of the technical literature and contacts with individual smelter operators. These estimates agree quite favorably with those developed in the Arthur D. Little study, which verified the Agency's conclusion that the overall energy requirements associated with reverberatory and electric smelting are essentially the same. It remains, the Administrator's conclusion, therefore, that there is no energy debit associated with electric smelting compared to reverberatory smelting.

Another commentator feels the Agency's original estimates fail to take into account the fuel necessary to maintain proper operating temperatures in sulfuric acid plants. This commentator estimates that about 82,000 barrels of fuel oil per year are required to heat the gases in a double absorption sulfuric acid plant. The commentator then assumes the domestic non-ferrous smelting industry will expand production by 50 percent in the immediate future, citing the Arthur D. Little study for support. Since about 30 metallurgical sulfuric acid plants are currently in use within the domestic smelting industry, the commentator assumes this means 15 new metallurgical sulfuric acid plants will be constructed in the future. This leads to an estimated energy impact associated with the standards of performance of about 1¼ million barrels of fuel oil per year.

It should be noted, however, that the growth projections developed in the Arthur D. Little study are only for the domestic copper smelting industry, and cannot be assumed to apply to the domestic zinc and lead smelting industries. Over half the domestic zinc smelters, for example, have shut down since 1968 and zinc production has fallen sharply, although recently plans have been announced for two new zinc smelters. In addition, the domestic lead industry is widely viewed as a static industry with little prospect for growth in the near future.

Furthermore, the Arthur D. Little study does not project a 50 percent expansion of the domestic copper smelting industry in the immediate future. By 1980, the study estimates domestic copper production will have increased by 15 percent over 1974 and by 1985, domestic copper production will have increased by 35 percent.

The Agency's growth projections for the domestic copper smelting industry are somewhat higher than those of the Arthur D. Little study and forecast a 19 percent increase in copper production by 1980 over 1974. The commentator's estimate of a 50 percent expansion of the domestic non-ferrous smelting industry in the immediate future, therefore, appears much too high. Where the commentator estimates that the standards of performance will affect the construction of 15 new metallurgical sulfuric acid plants, the Agency estimates the standards will affect the construction of 7 new acid plants (6 in the copper industry, 1 in the zinc industry and none in the lead industry). In addition, the Agency estimates the standards will require the conversion of 6 existing single absorption acid plants to double absorption (5 in the copper industry, 1 in the zinc industry and none in the lead industry).

As noted above, the commentator's calculations also assume that these 15 new metallurgical acid plants do not operate autothermally (i.e., fuel firing is necessary to maintain proper operating temperatures). The commentator's estimate that a double absorption sulfuric acid plant requires 82,000 barrels of fuel oil per year is based on operation of an acid plant designed to operate autothermally at 4½ percent sulfur dioxide, but which operates on gases containing only 3½ percent sulfur dioxide 40 percent of the time.

Using this same basis, the Agency calculates that a sulfuric acid plant should require less than 5,000 barrels of oil per year. A review of these calculations with two acid plant vendors and a private consultant has disclosed no errors. The Administrator must assume, therefore, that the commentator's calculations are in error, or assume an unrealistically low degree of heat recovery in the acid plant to preheat the incoming gases, or are based on a poorly designed or poorly operated sulfuric acid plant which fails to achieve the degree of heat recovery normally expected in a properly designed and operated sulfuric acid plant.

Regardless of these calculations, however, the Administrator feels that with good design, operation and maintenance of the roasters, smelting furnaces, concerters, sulfuric acid plant and the flue gas collection system and ductwork, the concentration of sulfur dioxide in the gases processed by a sulfuric acid plant can be maintained above 3½ to 4 percent sulfur dioxide. This level is typically the autothermal point at which no fuel need be fired to maintain proper operating temperatures in a well designed metallurgical sulfuric acid plant. Except for occasional start-ups, therefore, a well designed and properly operated metallurgical sulfuric acid plant should operate autothermally and not require fuel for maintaining proper operating temperatures. Thus, it remains the Administrator's conclusion that the impact of the standards on increased energy consumption, resulting from increased fuel consumption to operate sulfuric acid plants, is negligible.

(7) *Emission control technology.* As three commentators correctly noted, the proposed standards essentially require the use of one emission control technology—double absorption sulfuric acid plants. These commentators feel, however, that this prevents the use of alternative emission control technologies such as single absorption sulfuric acid plants and elemental sulfur plants, and that these are equally effective and, in the case of elemental sulfur plants, place less stress on the environment.

Although these commentators acknowledge that double absorption sulfuric acid plants operate at a higher efficiency than single absorption acid plants (99.5 percent vs. 97 percent), they feel the availability of double absorption plants is lower than that of single absorption plants (90 percent vs. 92 percent). These commentators also point out that double absorption acid plants require more energy to operate than single absorption plants. When the effect of these factors on overall sulfur dioxide emissions is considered, these commentators feel there is no essential difference between double and single absorption acid plants.

The difference in availability between single and double absorption sulfuric acid plants cited by these commentators was estimated from data gathered solely on single absorption acid plants, and is due essentially to only one item—that of the acid coolers for the sulfuric acid produced in the absorption towers. The data used by these commentators, however, reflects "old technology" in this respect. If the data are adjusted to reflect new acid cooler technology, the availability of single and double absorption acid plants is estimated to be 94 and 93.5 percent, respectively.

Taking into account these differences in efficiency and availability, the installation of a 1000-ton-per-day double absorption acid plant rather than a single absorption acid plant results in an annual reduction in sulfur dioxide emissions of about 4,500 tons. The difference in annual availability between single and double absorption acid plants, however, does not influence short-term emissions. Over short time periods the difference in emissions between single and double absorption acid plants is a reflection only of their difference in operating efficiency. Over a 24-hour period, for example, a 1000-ton-per-day single absorption acid pant will emit about 20 tons of sulfur dioxide compared to about 3.5 tons from a double absorption acid plant. Consequently, the difference in emission control obtained through the use of double absorption rather than single absorption acid plants is significant.

The increased sulfur dioxide emissions released to the atmosphere to provide the greater energy requirements of double absorption over single absorption acid plants is also minimal. For a nominal 1000-ton-per-day sulfuric acid plant, the difference in sulfur dioxide emissions between a single absorption plant and a double absorption plant is about 16.5 tons per day as mentioned above. The sulfur dioxide emissions from the combustion of a 1.0 percent sulfur fuel oil to provide the difference in energy required, however, is of the order of magnitude of only 200 pounds per day.

As mentioned above, these commentators also feel that elemental sulfur plants are as effective as double absorption sulfuric acid plants and place less stress on the environment. Elemental sulfur plants normally achieve emission reduction efficiencies of only about 90 percent, which is significantly lower than the 99+ percent normally achieved in double absorption sulfuric acid plants. Consequently, the Administrator does not consider elemental sulfur plants nearly as effective as double absorption sulfuric acid plants.

Although elemental sulfur presents no potential water pollution problems and can be easily stored, thus remaining a possible future resource, the Administrator does not agree that production of elemental sulfur places less stress on the environment than production of sulfuric acid. At every smelter now producing sulfuric acid, an outlet for this acid has been found, either in copper leaching operations to recover copper from oxide ores, or in the traditional acid markets, such as the production of fertilizer. Thus, sulfuric acid, unlike elemental sulfur, has found use as a current resource and not required storage for use as a possible future resource.

The Administrator believes that this situation will also generally prevail in the future. If sulfuric acid must be neutralized at a specific smelter, however, this can be accomplished with proper precautions without leading to water pollution problems, as discussed in the background information supporting the proposed standards.

A major drawback associated with the production of elemental sulfur, however, is the large amount of fuel required as a reductant in the process. When compared to sulfuric acid production in double absorption sulfuric acid plants, elemental sulfur production requires from 4 to 6 times as much energy. Consequently, the Administrator is not convinced that elemental sulfur production, which releases about 20 times more sulfur dioxide into the atmosphere, yet consumes 4 to 6 times as much energy, could be considered less stressful on the environment than sulfuric acid production.

PRIMARY ZINC SMELTERS

Only one major comment was submitted to the Agency concerning the proposed standards of performance for primary zinc smelters. This comment questioned whether it would be possible in all cases to eliminate 90 percent or more of the sulfur originally present in the zinc concentrates during roasting.

Most primary zinc smelters employ either the electrolytic smelting process or the roast/sinter smelting process, both of which require a roasting operation. The roast/sinter process, however, requires a sintering operation following roasting. Sulfur not removed from the concentrates during roasting is removed during sintering. Since the amount of sulfur removed by sintering is small, the gases discharged from this operation contain a low concentration of sulfur dioxide. As discussed in the preamble to the proposed standards, the cost of controlling these emissions was judged by the Administrator to be unreasonable.

The amount of sulfur dioxide emitted from the sintering machine, however, depends on the sulfur removal achieved in the preceding roaster. To ensure a high degree of sulfur removal during roasting which will minimize sulfur dioxide emissions from the sintering machine, the sulfur dioxide standard applies to any sintering machine which eliminates more than 10 percent of the sulfur originally present in the zinc concentrates. This requires 90 percent or more of the sulfur to be eliminated during roasting, which is consistent with good operation of roasters as presently practiced at the two zinc smelters in the United States which employ the roast/sinter process.

One commentator pointed out that calcium and magnesium which are present as impurities in some zinc concentrates could combine with sulfur during roasting to form calcium and magnesium sulfates. These materials would remain in the calcine (roasted concentrate). If these sulfates were reduced in the sintering operation, this could lead to more than 10 percent of the sulfur originally present in the zinc concentrates being emitted from the sintering machine. Under these conditions the sintering machine would be required to comply with the sulfur dioxide standard.

Although it is possible that this situation could arise, as acknowledged by the commentator himself it does not seem likely. Only a few zinc concentrates contain enough calcium and magnesium to carry as much as 10 percent of the sulfur in the concentrate over into the sintering operation, even assuming all the calcium and magnesium present combined with sulfur during the roasting operation.

In addition, a number of smelter operators contacted by the Agency indicated that it is quite possible that not all the calcium and magnesium present would combine with sulfur to form sulfates during roasting. It is equally possible, according to these operators, that not all the calcium and magnesium sulfates formed would be reduced in the sintering machine. Thus, even with those few concentrates which do contain a high level of calcium and magnesium, the extent to which calcium and magnesium might contribute to high sulfur emissions from the sintering operation is questionable.

Furthermore, these smelter operators indicated that at most zinc smelters a number of different zinc concentrates are normally blended to provide a homogeneous charge to the roasting operation. As pointed out by these operators, this effectively permits a smelter operator to reduce the amount of calcium and magnesium present in the charge by blending off the high levels of calcium and magnesium present in one zinc concentrate against the low levels present in another concentrate.

The Agency also discussed this potential problem with a number of mill operators. These operators indicated that additional milling could be employed to reduce calcium and magnesium levels in zinc concentrates. Although additional milling would entail some additional cost and probably result in a somewhat higher loss of zinc to the tailings, calcium and magnesium levels could be reduced well below the point where formation of calcium and magnesium sulfate during roasting would be of no concern.

While one may speculate that calcium and magnesium might lead to the formation of sulfates during roasting, which might in turn be reduced during sintering, the extent to which this would occur is unknown. Consequently, whether this would prevent a primary zinc smelter employing the roast/sinter process from limiting emissions from sintering to no more than 10 percent of the sulfur originally present in the zinc concentrates is questionable. The fact remains, however, that at the two primary zinc smelters currently operating in the United States which employ the roast/sinter process this has not been a problem. Furthermore, it appears that if calcium and magnesium were to present a problem in the future, a number of appropriate measures, such as additional blending of zinc concentrates or additional milling of those concentrates containing high calcium and magnesium levels, could be employed to deal with the situation. As a result, the standards of performance promulgated herein for primary zinc smelters require a sintering machine emitting more than 10 percent of the sulfur originally present in the zinc concentrates to comply with the sulfur dioxide standard for roasters.

PRIMARY LEAD SMELTERS

No major comments were submitted to the Agency concerning the proposed standards of performance for primary lead smelters. The proposed standards, therefore, are promulgated herein with only minor changes.

VISIBLE EMISSIONS

The opacity levels contained in the proposed standards to limit visible emissions have been reexamined to ensure they are consistent with the provisions promulgated by the Agency since proposal of these standards for determining compliance with visible emissions standards (39 FR 39872). These provisions specify, in part, that the opacity of visible emissions will be determined as a 6-minute average value of 24 consecutive readings taken at 15 second intervals. Reevaluation of the visible emission data on which the opacity levels in the proposed standards were based, in terms of 6-minute averages, indicates no need to change the opacity levels initially proposed. Consequently, the standards of performance are promulgated with the same opacity limits on visible emissions.

TEST METHODS

The proposed standards of performance for primary copper smelters, primary zinc smelters and primary lead smelters were accompanied by amendments to Appendix A—Reference Methods of 40 CFR Part 60. The purpose of these amendments was to add to Appendix A a new test method (Method 12) for use in determining compliance with the proposed standards of performance. Method 12 contained performance specifications for the sulfur dioxide monitors required in the proposed standards and prescribed the procedures to follow in demonstrating that a monitor met these performance specifications.

Since proposal of these standards of performance, the Administrator has proposed amendments to Subpart A—General Provisions of 40 CFR Part 60, establishing a consistent set of definitions and monitoring requirements applicable to all standards of performance. These amendments include a new appendix (Appendix B—Performance Specifications) which contains performance specifications and procedures to follow when demonstrating that a continuous monitor meets these performance specifications. A continuous monitoring system for measuring sulfur dioxide concentrations that is evaluated in accordance with the procedures contained in this appendix will be satisfactory for determining compliance with the standards promulgated herein for sulfur dioxide.

The proposed Method 12 is therefore withdrawn to prevent an unnecessary repetition of information in 40 CFR Part 60.

EFFECTIVE DATE

In accordance with section 111 of the Act, these regulations prescribing standards of performance for primary copper smelters, primary zinc smelters and primary lead smelters are effective on (date of publication) 1975 and apply to all affected facilities at these sources on which construction or modification commenced after October 16, 1974.

Dated: December 30, 1975.

JOHN QUARLES,
Acting Administrator.

Part 60 of Chapter I, Title 40 of the Code of Federal Regulations is amended as follows:

1. The table of sections is amended by adding subparts P, Q and R as follows:

* * * * *

Subpart P—Standards of Performance for Primary Copper Smelters

60.160 Applicability and designation of affected facility.
60.161 Definitions.
60.162 Standard for particulate matter.
60.163 Standard for sulfur dioxide.
60.164 Standard for visible emissions.
60.165 Monitoring of operations.
60.166 Test methods and procedures.

Subpart Q—Standards of Performance for Primary Zinc Smelters

60.170 Applicability and designation of affected facility.
60.171 Definitions.
60.172 Standard for particulate matter.
60.173 Standard for sulfur dioxide.
60.174 Standard for visible emissions.
60.175 Monitoring of operations.
60.176 Test methods and procedures.

Subpart R—Standards of Performance for Primary Lead Smelters

60.180 Applicability and designation of affected facility.
60.181 Definitions.
60.182 Standard for particulate matter.
60.183 Standard for sulfur dioxide.
60.184 Standard for visible emissions.
60.185 Monitoring of operations.
60.186 Test methods and procedures.

AUTHORITY: (Secs. 111, 114 and 301 of the Clean Air Act as amended (42 U.S.C. 1857c-6, 1857c-9, 1857g).)

* * * * *

2. Part 60 is amended by adding subparts P, Q and R as follows:

Subpart P—Standards of Performance for Primary Copper Smelters

§ 60.160 Applicability and designation of affected facility.

The provisions of this subpart are applicable to the following affected facilities in primary copper smelters: Dryer, roaster, smelting furnace, and copper converter.

§ 60.161 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in subpart A of this part.

(a) "Primary copper smelter" means any installation or any intermediate process engaged in the production of copper from copper sulfide ore concentrates through the use of pyrometallurgical techniques.

(b) "Dryer" means any facility in which a copper sulfide ore concentrate charge is heated in the presence of air to eliminate a portion of the moisture from the charge, provided less than 5 percent of the sulfur contained in the charge is eliminated in the facility.

(c) "Roaster" means any facility in which a copper sulfide ore concentrate charge is heated in the presence of air to eliminate a significant portion (5 percent or more) of the sulfur contained in the charge.

(d) "Calcine" means the solid materials produced by a roaster.

(e) "Smelting" means processing techniques for the melting of a copper sulfide ore concentrate or calcine charge leading to the formation of separate layers of molten slag, molten copper, and/or copper matte.

(f) "Smelting furnace" means any vessel in which the smelting of copper sulfide ore concentrates or calcines is performed and in which the heat necessary for smelting is provided by an electric current, rapid oxidation of a portion of the sulfur contained in the concentrate as it passes through an oxidizing atmosphere, or the combustion of a fossil fuel.

(g) "Copper converter" means any vessel to which copper matte is charged and oxidized to copper.

(h) "Sulfuric acid plant" means any facility producing sulfuric acid by the contact process.

(i) "Fossil fuel" means natural gas, petroleum, coal, and any form of solid, liquid, or gaseous fuel derived from such materials for the purpose of creating useful heat.

(j) "Reverberatory smelting furnace" means any vessel in which the smelting of copper sulfide ore concentrates or calcines is performed and in which the heat necessary for smelting is provided primarily by combustion of a fossil fuel.

(k) "Total smelter charge" means the weight (dry basis) of all copper sulfides ore concentrates processed at a primary copper smelter, plus the weight of all other solid materials introduced into the roasters and smelting furnaces at a primary copper smelter, except calcine, over a one-month period.

(l) "High level of volatile impurities" means a total smelter charge containing more than 0.2 weight percent arsenic, 0.1 weight percent antimony, 4.5 weight percent lead or 5.5 weight percent zinc, on a dry basis.

§ 60.162 Standard for particulate matter.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any dryer any gases which contain particulate matter in excess of 50 mg/dscm (0.022 gr/dscf).

§ 60.163 Standard for sulfur dioxide.

(b) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any roaster, smelting furnace, or copper converter any gases which contain sulfur dioxide in excess of 0.065 percent by volume, except as provided in paragraphs (b) and (c) of this section.

(b) Reverberatory smelting furnaces shall be exempted from paragraph (a) of this section during periods when the total smelter charge at the primary copper smelter contains a high level of volatile impurities.

(c) A change in the fuel combusted in a reverberatory furnace shall not be considered a modification under this part.

§ 60.164 Standard for visible emissions.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any dryer any visible emissions which exhibit greater than 20 percent opacity.

(b) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility that uses a sulfuric acid to comply with the standard set forth in § 60.163, any visible emissions which exhibit greater than 20 percent opacity.

§ 60.165 Monitoring of operations.

(a) The owner or operator of any primary copper smelter subject to § 60.163 (b) shall keep a monthly record of the total smelter charge and the weight percent (dry basis) of arsenic, antimony, lead and zinc contained in this charge. The analytical methods and procedures employed to determine the weight of the monthly smelter charge and the weight percent of arsenic, antimony, lead and zinc shall be approved by the Administrator and shall be accurate to within plus or minus ten percent.

(b) The owner or operator of any primary copper smelter subject to the provisions of this subpart shall install and operate:

(1) A continuous monitoring system to monitor and record the opacity of gases discharged into the atmosphere from any dryer. The span of this system shall be set at 80 to 100 percent opacity.

(2) A continuous monitoring system to monitor and record sulfur dioxide emissions discharged into the atmosphere from any roaster, smelting furnace or copper converter subject to § 60.163 (a). The span of this system shall be set at a sulfur dioxide concentration of 0.20 percent by volume.

(i) The continuous monitoring system performance evaluation required under § 60.13(c) shall be completed prior to the initial performance test required under § 60.8. During the performance evaluation, the span of the continuous monitoring system may be set at a sulfur dioxide concentration of 0.15 percent by volume if necessary to maintain the system output between 20 percent and 90 percent of full scale. Upon completion of the continuous monitoring system performance evaluation, the span of the continuous monitoring system shall be set at a sulfur dioxide concentration of 0.20 percent by volume.

(ii) For the purpose of the continuous monitoring system performance evaluation required under § 60.13(c) the reference method referred to under the Field Test for Accuracy (Relative) in Performance Specification 2 of Appendix B to this part shall be Reference Method 6. For the performance evaluation, each concentration measurement shall be of one hour duration. The pollutant gas used to prepare the calibration gas mixtures required under paragraph 2.1, Performance Specification 2 of Appendix B, and for calibration checks under § 60.13 (d), shall be sulfur dioxide.

(c) Six-hour average sulfur dioxide concentrations shall be calculated and recorded daily for the four consecutive 6-hour periods of each operating day. Each six-hour average shall be determined as the arithmetic mean of the appropriate six contiguous one-hour average sulfur dioxide concentrations provided by the continuous monitoring system installed under paragraph (b) of this section.

(d) For the purpose of reports required under § 60.7(c), periods of excess emissions that shall be reported are defined as follows:

(1) Opacity. Any six-minute period during which the average opacity, as measured by the continuous monitoring system installed under paragraph (b) of this section, exceeds the standard under § 60.164(a).

(2) Sulfur dioxide. Any six-hour period, as described in paragraph (c) of this section, during which the average emissions of sulfur dioxide, as measured by the continuous monitoring system installed under paragraph (b) of this section, exceeds the standard under § 60.163.

§ 60.166 Test methods and procedures.

(a) The reference methods in Appendix A to this part, except as provided for in § 60.8(b), shall be used to determine compliance with the standards prescribed in §§ 60.162, 60.163 and 60.164 as follows:

(1) Method 5 for the concentration of particulate matter and the associated moisture content.

(2) Sulfur dioxide concentrations shall be determined using the continuous monitoring system installed in accordance with § 60.165(b). One 6-hour average period shall constitute one run. The monitoring system drift during any run shall not exceed 2 percent of span.

(b) For Method 5, Method 1 shall be used for selecting the sampling site and the number of traverse points, Method 2 for determining velocity and volumetric flow rate and Method 3 for determining the gas analysis. The sampling time for each run shall be at least 60 minutes and the minimum sampling volume shall be 0.85 dscm (30 dscf) except that smaller times or volumes, when necessitated by process variables or other factors, may be approved by the Administrator.

Subpart Q—Standards of Performance for Primary Zinc Smelters

§ 60.170 Applicability and designation of affected facility.

The provisions of this subpart are applicable to the following affected facilities in primary zinc smelters: roaster and sintering machine.

§ 60.171 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in subpart A of this part.

(a) "Primary zinc smelter" means any installation engaged in the production, or any intermediate process in the production, of zinc or zinc oxide from zinc sulfide ore concentrates through the use of pyrometallurgical techniques.

(b) "Roaster" means any facility in which a zinc sulfide ore concentrate charge is heated in the presence of air to eliminate a significant portion (more than 10 percent) of the sulfur contained in the charge.

(c) "Sintering machine" means any furnace in which calcines are heated in the presence of air to agglomerate the calcines into a hard porous mass called "sinter."

(d) "Sulfuric acid plant" means any facility producing sulfuric acid by the contact process.

§ 60.172 Standard for particulate matter.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any sintering machine any gases which contain particulate matter in excess of 50 mg/dscm (0.022 gr/dscf).

§ 60.173 Standard for sulfur dioxide.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any roaster any gases which contain sulfur dioxide in excess of 0.065 percent by volume.

(b) Any sintering machine which eliminates more than 10 percent of the sulfur initially contained in the zinc sulfide ore concentrates will be considered as a roaster under paragraph (a) of this section.

§ 60.174 Standard for visible emissions.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any sintering machine any visible emissions which exhibit greater than 20 percent opacity.

(b) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility that uses a sulfuric acid plant to comply with the standard set forth in § 60.173, any visible emissions which exhibit greater than 20 percent opacity.

§ 60.175 Monitoring of operations.

(a) The owner or operator of any primary zinc smelter subject to the provisions of this subpart shall install and operate:

(1) A continuous monitoring system to monitor and record the opacity of gases discharged into the atmosphere from any sintering machine. The span of this system shall be set at 80 to 100 percent opacity.

(2) A continuous monitoring system to monitor and record sulfur dioxide emissions discharged into the atmosphere from any roaster subject to § 60.173. The span of this system shall be set at a sulfur dioxide concentration of 0.20 percent by volume.

(i) The continuous monitoring system performance evaluation required under § 60.13(c) shall be completed prior to the initial performance test required under § 60.8. During the performance evaluation, the span of the continuous monitoring system may be set at a sulfur dioxide concentration of 0.15 percent by volume if necessary to maintain the system output between 20 percent and 90 percent of full scale. Upon completion of the continuous monitoring system performance evaluation, the span of the continuous monitoring system shall be set at a sulfur dioxide concentration of 0.20 percent by volume.

(ii) For the purpose of the continuous monitoring system performance evaluation required under § 60.13(c), the reference method referred to under the Field Test for Accuracy (Relative) in Performance Specification 2 of Appendix B to this part shall be Reference Method 6. For the performance evaluation, each concentration measurement shall be of one hour duration. The pollutant gas used to prepare the calibration gas mixtures required under paragraph 2.1, Performance Specification 2 of Appendix B, and for calibration checks under § 60.13 (d), shall be sulfur dioxide.

(b) Two-hour average sulfur dioxide concentrations shall be calculated and recorded daily for the twelve consecutive 2-hour periods of each operating day. Each two-hour average shall be determined as the arithmetic mean of the appropriate two contiguous one-hour average sulfur dioxide concentrations provided by the continuous monitoring system installed under paragraph (a) of this section.

(c) For the purpose of reports required under § 60.7(c), periods of excess emissions that shall be reported are defined as follows:

(1) Opacity. Any six-minute period during which the average opacity, as measured by the continuous monitoring system installed under paragraph (a) of this section, exceeds the standard under § 60.174(a).

(2) Sulfur dioxide. Any two-hour period, as described in paragraph (b) of this section, during which the average emissions of sulfur dioxide, as measured by the continuous monitoring system installed under paragraph (a) of this section, exceeds the standard under § 60.173.

§ 60.176 Test methods and procedures.

(a) The reference methods in Appendix A to this part, except as provided for in § 60.8(b), shall be used to determine compliance with the standards prescribed in §§ 60.172, 60.173 and 60.174 as follows:

(1) Method 5 for the concentration of particulate matter and the associated moisture content.

(2) Sulfur dioxide concentrations shall be determined using the continuous monitoring system installed in accordance with § 60.175(a). One 2-hour average period shall constitute one run.

(b) For Method 5, Method 1 shall be used for selecting the sampling site and the number of traverse points, Method 2 for determining velocity and volumetric flow rate and Method 3 for determining the gas analysis. The sampling time for each run shall be at least 60 minutes and the minimum sampling volume shall be 0.85 dscm (30 dscf) except that smaller times or volumes, when necessitated by process variables or other factors, may be approved by the Administrator.

Subpart R—Standards of Performance for Primary Lead Smelters

§ 60.180 Applicability and designation of affected facility.

The provisions of this subpart are applicable to the following affected facilities in primary lead smelters: sintering machine, sintering machine discharge end, blast furnace, dross reverberatory furnace, electric smelting furnace, and converter.

§ 60.181 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in subpart A of this part.

(a) "Primary lead smelter" means any installation or any intermediate process engaged in the production of lead from lead sulfide ore concentrates through the use of pyrometallurgical techniques.

(b) "Sintering machine" means any furnace in which a lead sulfide ore concentrate charge is heated in the presence of air to eliminate sulfur contained in the charge and to agglomerate the charge into a hard porous mass called "sinter."

(c) "Sinter bed" means the lead sulfide ore concentrate charge within a sintering machine.

(d) "Sintering machine discharge end" means any apparatus which receives sinter as it is discharged from the conveying grate of a sintering machine.

(e) "Blast furnace" means any reduction furnace to which sinter is charged and which forms separate layers of molten slag and lead bullion.

(f) "Dross reverberatory furnace" means any furnace used for the removal or refining of impurities from lead bullion.

(g) "Electric smelting furnace" means any furnace in which the heat necessary for smelting of the lead sulfide ore concentrate charge is generated by passing an electric current through a portion of the molten mass in the furnace.

(h) "Converter" means any vessel to which lead concentrate or bullion is charged and refined.

(i) "Sulfuric acid plant" means any facility producing sulfuric acid by the contact process.

§ 60.182 Standard for particulate matter.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any blast furnace, dross reverberatory furnace, or sintering machine discharge end any gases which contain particulate matter in excess of 59 mg/dscm (0.022 gr/dscf).

§ 60.183 Standard for sulfur dioxide.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any sintering machine, electric smelting furnace, or converter gases which contain sulfur dioxide in excess of 0.065 percent by volume.

§ 60.184 Standard for visible emissions.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any blast furnace, dross reverberatory furnace, or sintering machine discharge end any visible emissions which exhibit greater than 20 percent opacity.

(b) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility that uses a sulfuric acid plant to comply with the standard set forth in § 60.183, any visible emissions which exhibit greater than 20 percent opacity.

§ 60.185 Monitoring of operations.

(a) The owner or operator of any primary lead smelter subject to the provisions of this subpart shall install and operate:

(1) A continuous monitoring system to monitor and record the opacity of gases discharged into the atmosphere from any blast furnace, dross reverberatory furnace, or sintering machine discharge end. The span of this system shall be set at 80 to 100 percent opacity.

(2) A continuous monitoring system to monitor and record sulfur dioxide emissions discharged into the atmosphere from any sintering machine, electric furnace or converter subject to § 60.183. The span of this system shall be set at a sulfur dioxide concentration of 0.20 percent by volume.

(i) The continuous monitoring system performance evaluation required under § 60.13(c) shall be completed prior to the initial performance test required under § 60.8. During the performance evaluation, the span of the continuous monitoring system may be set at a sulfur dioxide concentration of 0.15 percent by volume if necessary to maintain the system output between 20 percent and 90 percent of full scale. Upon completion of the continuous monitoring system performance evaluation, the span of the continuous monitoring system shall be set at a sulfur dioxide concentration of 0.20 percent by volume.

(ii) For the purpose of the continuous monitoring system performance evaluation required under § 60.13(c), the reference method referred to under the Field Test for Accuracy (Relative) in Performance Specification 2 of Appendix B to this part shall be Reference Method 6. For the performance evaluation, each concentration measurement shall be of one hour duration. The pollutant gases used to prepare the calibration gas mixtures required under paragraph 2.1, Performance Specification 2 of Appendix B, and for calibration checks under § 60.13(d), shall be sulfur dioxide.

(b) Two-hour average sulfur dioxide concentrations shall be calculated and recorded daily for the twelve consecutive two-hour periods of each operating day. Each two-hour average shall be determined as the arithmetic mean of the appropriate two contiguous one-hour average sulfur dioxide concentrations provided by the continuous monitoring system installed under paragraph (a) of this section.

(c) For the purpose of reports required under § 60.7(c), periods of excess emissions that shall be reported are defined as follows:

(1) Opacity. Any six-minute period during which the average opacity, as measured by the continuous monitoring system installed under paragraph (a) of this section, exceeds the standard under § 60.184(a).

(2) Sulfur dioxide. Any two-hour period, as described in paragraph (b) of this section, during which the average emissions of sulfur dioxide, as measured by the continuous monitoring system installed under paragraph (a) of this section, exceeds the standard under § 60.183.

§ 60.186 Test methods and procedures.

(a) The reference methods in Appendix A to this part, except as provided for in § 60.8(b), shall be used to determine compliance with the standards prescribed in §§ 60.182, 60.183 and 60.184 as follows:

(1) Method 5 for the concentration of particulate matter and the associated moisture content.

(2) Sulfur dioxide concentrations shall be determined using the continuous monitoring system installed in accordance with § 60.185(a). One 2-hour average period shall constitute one run.

(b) For Method 5, Method 1 shall be used for selecting the sampling site and the number of traverse points, Method 2 for determining velocity and volumetric flow rate and Method 3 for determining the gas analysis. The sampling time for each run shall be at least 60 minutes and the minimum sampling volume shall be 0.85 dscm (30 dscf) except that smaller times or volumes, when necessitated by process variables or other factors, may be approved by the Administrator.

[FR Doc.76-733 Filed 1-14-76;8:45 am]

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Title 40—Protection of Environment

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

SUBCHAPTER C—AIR PROGRAMS

[FRL 471-4]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Primary Aluminum Industry

On October 23, 1974 (39 FR 37730), under sections 111 and 114 of the Clean Air Act (42 U.S.C. 1857c-6, 1857c-9), as amended, the Administrator proposed standards of performance for new and modified primary aluminum reduction plants. Interested persons participated in the rulemaking by submitting written comments to EPA. The comments have been carefully considered and, where determined by the Administrator to be appropriate, changes have been made in the regulations as promulgated.

These regulations will not, in themselves, require control of emissions from existing primary aluminum reduction plants. Such control will be required only after EPA establishes emission guidelines for existing plants under section 111(d) of the Clean Air Act, which will trigger the adoption of State emission standards for existing plants. General regulations concerning control of existing sources under section 111(d) were proposed on October 7, 1975 (39 FR 36102) and were promulgated on November 17, 1975 (40 FR 53339).

The bases for the proposed standards are presented in the first two volumes of a background document entitled "Background Information for Standards of Performance: Primary Aluminum Industry." Volume 1 (EPA 450/2-74-020a, October 1974) contains the rationale for the proposed standards and Volume 2 (EPA 450/2-74-020b, October 1974) contains a summary of the supporting test data. An inflation impact statement for the standards and a summary of the comments received on the proposed standards along with the Agency responses are contained in a new Volume 3 (EPA 450/2-74-020c, November 1975) of the background document. Copies of all three volumes of the background documents are available on request from the Emission Standards and Engineering Division, Environmental Protection Agency, Research Triangle Park, N.C. 27711, Attention: Mr. Don R. Goodwin.

SUMMARY OF REGULATIONS

The standards of performance promulgated herein limit emissions of gaseous and particulate fluorides from new and modified affected facilities within primary aluminum reduction plants. The standard for fluorides limits emissions from each potroom group within Soderberg plants to 2.0 pounds of total fluorides per ton of aluminum produced (lb TF/TAP), from each potroom group within prebake plants to 1.9 lb TF/TAP, and from each anode bake plant within prebake plants to 0.1 lb TF/TAP. Primary and secondary emission from potroom groups are limited to less than 10 percent opacity, and emissions from anode bake plants are limited to less than 20 percent opacity. The regulations require monitoring of raw material feed rates, cell or potline voltages, and daily production rate of aluminum and anodes. Also included with the standards is Reference Method 14 which specifies equipment and sampling procedures for emission testing of potroom roof monitors. Fluoride samples collected during performance tests will be analyzed according to Reference Method 13A or 13B which were promulgated along with standards of performance for the phosphate fertilizer industry on August 6, 1975 (40 FR 33152).

SIGNIFICANT COMMENTS AND CHANGES MADE TO THE PROPOSED REGULATIONS

Most of the comment letters received by EPA contained multiple comments. Copies of the comment letters received and a summary of the comments and Agency responses are available for public inspection and copying at the U.S. Environmental Protection Agency, Public Information Reference Unit, Room 2922 (EPA Library), 401 M Street, S.W., Washington, D.C. 20460. In addition, copies of the issue summary and Agency responses may be obtained upon written request from the EPA Public Information Center (PM-215), 401 M Street, SW., Washington, D.C. 20460 [specify "Background Information for Standards of Performance: Primary Aluminum Industry Volume 3: Supplemental Information" (EPA 45/2-74-020c)]. The most significant comments and changes made to the proposed regulations are discussed below.

(1) *Designation of Affected Facility.* Several comments questioned the "applicability and designation of affected facility" section of the proposed regulations (§ 60.190) in view of regulations previously proposed by EPA with regard to modification of existing plants (39 FR 36946, October 15, 1974). In § 60.190 as proposed, the entire primary aluminum reduction plant was designated as the affected facility. The commentators argued that, as a result of this designation, addition or modification of a single potroom at an existing plant would subject all existing potrooms at the plant to the standards for new sources. The commentators argued that this situation would unfairly restrict expansion. The Agency considered these comments and agreed that there would be an adverse economic impact on expansion of existing plants unless the affected facility designation were revised.

To alleviate the problem, a new affected facility designation has been incorporated in § 60.190(a). The affected facilities within primary aluminum plants are now each "potroom group" and each anode bake plant within prebake plants. This redesignation in turn required splitting the fluoride standard for prebake plants into separate standards for potroom groups and anode bake plants (see discussion in next section). As defined in § 60.191(d), the term "potroom group" means an uncontrolled potroom, or a potroom which is controlled individually, or a group of potrooms ducted to the same control system. Under this revised designation, addition or modification of a potroom group at an existing plant will not subject the entire plant to the standards (unless the plant consists of only one potroom group). Similarly, addition or modification of an anode bake plant at an exiting prebake facility will not subject the entire prebake facility to the standards. Only the new or modified potroom group or anode bake plant must meet the applicable standards in such cases.

(2) *Fluoride Standard.* Many commentators questioned the level of the proposed standard; i.e., 2.0 lb TF/TAP. A number of industrial commentators suggested that the standard be relaxed or that it be specified in terms of a monthly or yearly emission limit. Some commentators argued that the test data did not support the standard and that statistical techniques should have been applied to the test data in order to arrive at an emission standard.

Standards of performance under section 111 are based on the best control technology which (taking into account control costs) has been "adequately demonstrated." "Adequately demonstrated" means that the Administrator must determine, on the basis of all information available to him (including but not limited to tests and observations of existing plants and demonstration projects or pilot applications) and the exercise of sound engineering judgment, that the control technology relied upon in setting a standard of performance can be made available and will be effective to enable sources to comply with the standards. In other words, test data for existing plants are not the only bases for standard setting. As discussed in the background document, EPA considered not only test data for existing plants, but also the expected performance of newly constructed plants. Some existing plants tested did average less than 2.0 lb TF/TAP. Additionally, EPA believes new plants can be specifically designed for best control of air pollutants and, therefore, that new plant emission control performance should exceed that of well-controlled existing plants. Finally, relatively simple changes in current operating methods (e.g., cell tapping) can produce significant reductions in emissions. For these reasons, EPA believes the 2.0 lb TF/TAP standard is both reasonable and achievable. A more detailed discussion of the rationale for selecting the 2.0 lb TF/TAP standard is contained in Volume 1 of the background document, and EPA's responses to specific comments on the fluoride standard are contained in Volume 3.

As a result of the revised affected facility designation, the 2.0 lb TF/TAP standard for prebake plants has been split into separate standards for potroom groups (1.9 lb TF/TAP) and anode bake plants (0.1 lb TF/TAP). The proposed 2.0 lb TF/TAP limitation for prebake plants always consisted of these two components, but was published as a combined standard to be consistent with the original affected facility designation (i.e., the entire primary aluminum plant). At the time of proposal, the Agency had not foreseen the potential problems with modification of a two part affected facility. Data supporting each component of the standard as proposed is contained in the background document (Volumes 1 and 2). In support of the potroom component of the standard, for example, two existing prebake potrooms tested by the Agency averaged less than 1.9 lb TF/TAP. Because no well controlled anode bake plants existed at the time of aluminum plant testing, the components for anode bake plants was based on a conservatively assumed control efficiency for technology demonstrated in the phosphate fertilizer industry. Using the highest emission rate observed at two anode bake plants which were not controlled for fluorides and applying the assumed control efficiency, it was projected that these plants would emit approximately 0.06 lb TF/TAP (0.12 lb TF/ton of carbon anodes produced). In addition, as indicated in Volume 1 of the background document, it may be possible to meet the standard for anode bake plants simply by better cleaning of anode remnants. The Agency also has estimates of emission rates for a prebake facility to be built in the near future. The estimates indicate that the anode bake plant at the facility will easily meet the 0.1 TF/TAP standard.

One commentator questioned why the standard was not more stringent considering the fact that Oregon has promulgated the following standards for new primary aluminum plants: (a) a monthly average of 1.3 pounds of fluoride ion per ton of aluminum produced, and (b) an annual average of 1.0 pound of fluoride ion per ton of aluminum produced.

There are several reasons why the Agency elected not to adopt standards equivalent to the Oregon standards. Perhaps most important, EPA believes that the Oregon standards would require the installation of relatively inefficient secondary scrubbing systems at most if not all new primary aluminum plants. By contrast, EPA's standard will require use of secondary control systems only for vertical stud Soderberg (VSS) plants (which are unlikely to be built in any event) and side-work prebake plants. A standard requiring secondary control systems on most if not all plants would have a substantial adverse economic impact on the aluminum industry, as is indicated in the economic section of the background document. Accordingly, EPA has concluded that considerations of cost preclude establishing a standard comparable to the Oregon standards.

A second reason for not adopting standards equivalent to the Oregon standards stems from the fact that the latter were based on test data consisting of six monthly averages (calculated by averaging from three to nine individual tests each month) from a certain well controlled plant (which incorporates both primary and secondary control). Oregon applied a statistical method to these data to derive the emission standards it adopted. As discussed in the comment summary, EPA also performed a statistical analysis of the Oregon test data, which yielded results different from those presented in the Oregon technical report. If the Agency's results had been used, less stringent emission standards might have been promulgated in Oregon.

A third consideration is that the test methods used by Oregon were not the same as those used by the Agency to collect emission data in support of the respective standards. Therefore, Oregon's test data and the Agency's test data are not directly comparable.

Finally, a comment on the standard for fluorides questioned whether or not EPA had considered a new, potentially non-polluting primary aluminum reduction process developed by Alcoa. The commentator argued that if the process had become commercially available, the standard should be set at a level sufficiently stringent to stimulate the development of this new process. In response to this comment, EPA has investigated the process and has determined that it is not yet commercially available. Alcoa plans to test the process at a small pilot plant which will begin production early next year. If the pilot plant performs successfully, it will be expanded to full design capacity by the early 1980's. EPA will monitor the progress of this process and other processes under development and will reevaluate the standards of performance for the primary aluminum industry, as appropriate, in light of the new technology.

(3) *Opacity*. Some of the industrial commentators objected to the proposed opacity standards for potrooms and anode bake plants. They argued that good control of total fluorides will result in good control of particulate matter, and therefore that the opacity standards are unnecessary. EPA agrees that good control of total fluorides will result in good control of particulate matter; however, the opacity standards are intended to serve as inexpensive enforcement tools that will help to insure proper operation and maintenance of the air pollution control equipment. Under 40 CFR 60.11(d), owners and operators of affected facilities are required to operate and maintain their control equipment properly at all times. Continuous monitoring instruments are often required to indicate compliance with 60.11(d), but this is not possible in the primary aluminum industry because continuous total fluoride monitors are not commercially available. The data presented in the background document indicate that the opacity standards can be easily met at well controlled plants that are properly operated and maintained. For these reasons, the opacity standards have been retained in the final regulations.

EPA recognizes, however, that in unusual circumstances (e.g., where emissions exit from an extremely wide stack) a source might meet the mass emission limit but fail to meet the opacity limit. In such cases, the owner or operator of the source may petition the Administrator to establish a separate opacity standard under 40 CFR 60.11(e) as revised on November 12, 1974 (39 FR 39872).

(4) *Control of Other Pollutants*. One commentator was concerned that EPA did not propose standards for carbon monoxide (CO) and sulfur dioxide (SO_2) emissions from aluminum plants. The commentator argued that aluminum smelters are significant sources of these pollutants, and that although fluorides are the most toxic aluminum plant emissions, standards for all pollutants should have been proposed. As discussed in the preface to Volume 1 of the background document, fluoride control was selected as one area of emphasis to be considered in implementing the Clean Air Act. In turn, primary aluminum plants were identified as major sources of fluoride emissions and were accordingly listed as a category of sources for which standards of performance would be proposed. Naturally, the initial investigation into standards for the primary aluminum industry focused on fluoride control. However, limited testing of CO and SO_2 emissions was also carried out and it was determined (a) that although primary aluminum plants might be a significant source of SO_2, SO_2 control technology had not been demonstrated in the industry, and (b) that CO emissions from such plants were insignificant. For these reasons, standards of performance were not proposed for SO_2 and CO emissions.

It is possible that SO_2 control technology used in other industries might be applicable to aluminum plants, and recent information indicates that CO emissions from such plants may be significant. At present, however, EPA has insufficient data on which to base SO_2 and CO emission standards for aluminum plants. EPA will consider the factors mentioned above and other relevant information in assigning priorities for future standard setting and invites submission of pertinent information by any interested parties. Thus, standards for CO and SO_2 emissions from primary aluminum plants may be set in the future.

(5) *Reference Methods 13A and 13B*. These methods prescribe sampling and analysis procedures for fluoride emissions and are applicable to the testing of phosphate fertilizer plants in addition to primary aluminum plants. The methods were originally proposed with the primary aluminum regulations but have been promulgated with the standards of performance for the phosphate fertilizer industry (published August 6, 1975, 40 FR 33152) because the fertilizer regulations were promulgated before those for primary aluminum. Comments on the methods were received from both industries and mainly concerned possible changes in procedures and equipment specifications. As discussed in the preamble to the phosphate fertilizer regulations, some minor changes were made as a result of these comments.

Some commentators expressed a desire to replace Methods 13A and 13B with totally different methods of analysis. They felt that they should not be restricted to using only those methods published by the Agency. In response to these comments, an equivalent or alternative method may be used if approved by the Administrator under 40 CFR 60.8(b) as revised on March 8, 1974 (39 FR 9308).

(6) *Reference Method 14.* Reference Method 14 specifies sampling equipment and sampling procedures for measuring fluoride emissions from roof monitors. Most comments concerning this method suggested changes in the prescribed manifold system. A number of commentators objected to the requirement that stainless steel be used as the structural material for the manifold and suggested that other, less expensive structural materials would work as well. Data submitted by one aluminum manufacturer supported the use of aluminum for manifold construction. The Agency reviewed these data and concluded that an aluminum manifold will provide satisfactory fluoride samples if the manifold is conditioned prior to testing by passing fluoride-laden air through the system. By using aluminum instead of stainless steel, the cost of installing a sampling manifold would be substantially reduced. Since the Agency had no data on other possible structural materials, it was not possible to endorse their use in the method. However, the following wording addressing this subject has been added to the method text (§ 2.2.1): "Other materials of construction may be used if it is demonstrated through comparative testing that there is no loss of fluorides in the system."

Some commentators also objected to the requirement that the mean velocity measured during fluoride sampling be within ±10 percent of the previous 24-hour average velocity recorded through the system. In order to reduce the number of rejected sampling runs due to failure to meet the above criteria, the requirement has been amended such that the mean sampling velocity must be within ±20 percent of the previous 24-hour average velocity. EPA believes that the relaxation of this requirement will not compromise the accuracy of the method.

(7) *Economic Impact.* Some comments raised questions regarding the economic impact of the proposed regulations. The Agency has considered these comments and responded to them in the comment summary cited above. As indicated previously, an analysis of the inflationary and energy impacts of the standards appears in Volume 3 of the background document. Copies of these documents may be obtained as indicated previously.

Effective date. In accordance with section 111 of the Act, these regulations are effective January 26, 1976 and apply to sources the construction or modification of which commenced after proposal of the standards; i.e., after October 23, 1974.

(It is hereby certified that the economic and inflationary impacts of this regulation have been carefully evaluated in accordance with Executive Order 11821)

Dated: January 19, 1976.

RUSSELL E. TRAIN,
Administrator.

Part 60 of Chapter I, Title 40 of the Code of Federal Regulations, is amended as follows:

1. The table of sections is amended by adding a list of sections for Subpart S and by adding Reference Method 14 to the list of reference methods in Appendix A as follows:

Subpart S—Standards of Performance for Primary Aluminum Reduction Plants

Sec.
60.190 Applicability and designation of affected facility.
60.191 Definitions.
60.192 Standard for fluorides.
60.193 Standard for visible emissions.
60.194 Monitoring of operations.
60.195 Test methods and procedures.

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APPENDIX A—REFERENCE METHODS

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METHOD 14—DETERMINATION OF FLUORIDE EMISSIONS FROM POTROOM ROOF MONITORS OF PRIMARY ALUMINUM PLANTS

AUTHORITY: Secs. 111 and 114, Clean Air Act, as amended by sec. 4(a), Pub. L. 91-604, 84 Stat. 1678, 42 U.S.C. 1857 C-6, C-9.

2. Part 60 is amended by adding subpart S as follows:

Subpart S—Standards of Performance for Primary Aluminum Reduction Plants

§ 60.190 Applicability and designation of affected facility.

The affected facilities in primary aluminum reduction plants to which this subpart applies are potroom groups and anode bake plants.

§ 60.191 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in subpart A of this part.

(a) "Primary aluminum reduction plant" means any facility manufacturing aluminum by electrolytic reduction.

(b) "Anode bake plant" means a facility which produces carbon anodes for use in a primary aluminum reduction plant.

(c) "Potroom" means a building unit which houses a group of electrolytic cells in which aluminum is produced.

(d) "Potroom group" means an uncontrolled potroom, a potroom which is controlled individually, or a group of potrooms ducted to the same control system.

(e) "Roof monitor" means that portion of the roof of a potroom where gases not captured at the cell exit from the potroom.

(f) "Aluminum equivalent" means an amount of aluminum which can be produced from a ton of anodes produced by an anode bake plant as determined by § 60.195(e).

(g) "Total fluorides" means elemental fluorine and all fluoride compounds as measured by reference methods specified in § 60.195 or by equivalent or alternative methods [see § 60.8(b)].

(h) "Primary control system" means an air pollution control system designed to remove gaseous and particulate fluorides from exhaust gases which are captured at the cell.

(i) "Secondary control system" means an air pollution control system designed to remove gaseous and particulate fluorides from gases which escape capture by the primary control system.

§ 60.192 Standard for fluorides.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility any gases which contain total fluorides in excess of:

(1) 1 kg/metric ton (2 lb/ton) of aluminum produced for vertical stud Soderberg and horizontal stud Soderberg plants;

(2) 0.95 kg/metric ton (1.9 lb/ton) of aluminum produced for potroom groups at prebake plants; and

(3) 0.05 kg/metric ton (0.1 lb/ton) of aluminum equivalent for anode bake plants.

§ 60.193 Standard for visible emissions.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere:

(1) From any potroom group any gases which exhibit 10 percent opacity or greater, or

(2) From any anode bake plant any gases which exhibit 20 percent opacity or greater.

§ 60.194 Monitoring of operations.

(a) The owner or operator of any affected facility subject to the provisions of this subpart shall install, calibrate, maintain, and operate monitoring devices which can be used to determine daily the weight of aluminum and anode produced. The weighing devices shall have an accuracy of ±5 percent over their operating range.

(b) The owner or operator of any affected facility shall maintain a record of daily production rates of aluminum and anodes, raw material feed rates, and cell or potline voltages.

§ 60.195 Test methods and procedures.

(a) Except as provided in § 60.8(b), reference methods specified in Appendix A of this part shall be used to determine compliance with the standards prescribed in § 60.192 as follows:

(1) For sampling emissions from stacks:

(i) Method 13A or 13B for the concentration of total fluorides and the associated moisture content,

(ii) Method 1 for sample and velocity traverses,

(iii) Method 2 for velocity and volumetric flow rate, and

(iv) Method 3 for gas analysis.

(2) For sampling emissions from roof monitors not employing stacks or pollutant collection systems:

(i) Method 14 for the concentration of total fluorides and associated moisture content,

(ii) Method 1 for sample and velocity traverses,

(iii) Method 2 and Method 14 for velocity and volumetric flow rate, and

(iv) Method 3 for gas analysis.

(3) For sampling emissions from roof monitors not employing stacks but equipped with pollutant collection systems, the procedures under § 60.8(b) shall be followed.

(b) For Method 13A or 13B, the sampling time for each run shall be at least eight hours for any potroom sample and at least four hours for any anode bake plant sample, and the minimum sample volume shall be 6.8 dscm (240 dscf) for any potroom sample and 3.4 dscm (120 dscf) for any anode bake plant sample except that shorter sampling times or smaller volumes, when necessitated by process variables or other factors, may be approved by the Administrator.

(c) The air pollution control system for each affected facility shall be constructed so that volumetric flow rates and total fluoride emissions can be accurately determined using applicable methods specified under paragraph (a) of this section.

(d) The rate of aluminum production shall be determined as follows:

(1) Determine the weight of aluminum in metric tons produced during a period from the last tap before a run starts until the first tap after the run ends using a monitoring device which meets the requirements of § 60.194(a).

(2) Divide the weight of aluminum produced by the length of the period in hours.

(e) For anode bake plants, the aluminum equivalent for anodes produced shall be determined as follows:

(1) Determine the average weight (metric tons) of anode produced in the anode bake plant during a representative oven cycle using a monitoring device which meets the requirements of § 60.194(a).

(2) Determine the average rate of anode production by dividing the total weight of anodes produced during the representative oven cycle by the length of the cycle in hours.

(3) Calculate the aluminum equivalent for anodes produced by multiplying the average rate of anode production by two. (Note: an owner or operator may establish a different multiplication factor by submitting production records of the tons of aluminum produced and the concurrent tons of anode consumed by potrooms.)

(f) For each run, potroom group emissions expressed in kg/metric ton of aluminum produced shall be determined using the following equation:

$$E_{pg} = \frac{(C_s Q_s)_1 10^{-6} + (C_s Q_s)_2 10^{-6}}{M}$$

where:

E_{pg}=potroom group emissions of total fluorides in kg/metric ton of aluminum produced.

C_s=concentration of total fluorides in mg/dscm as determined by Method 13A or 13B, or by Method 14, as applicable.

Q_s=volumetric flow rate of the effluent gas stream in dscm/hr as determined by Method 2 and/or Method 14, as applicable.

10^{-6}=conversion factor from mg to kg.

M=rate of aluminum production in metric ton/hr as determined by § 60.195(d).

$(C_s Q_s)_1$=product of C_s and Q_s for measurements of primary control system effluent gas streams.

$(C_s Q_s)_2$=product of C_s and Q_s for measurements of secondary control system or roof monitor effluent gas streams.

(g) For each run, as applicable, anode bake plant emissions expressed in kg/metric ton of aluminum equivalent shall be determined using the following equation:

$$E_{bp} = \frac{C_s Q_s 10^{-6}}{M_e}$$

Where:

E_{bp}=anode bake plant emissions of total fluorides in kg/metric ton of aluminum equivalent.

C_s=concentration of total fluorides in mg/dscm as determined by Method 13A or 13B.

Q_s=volumetric flow rate of the effluent gas stream in dscm/hr as determined by Method 2.

10^{-6}=conversion factor from mg to kg.

M_e=aluminum equivalent for anodes produced by anode bake plants in metric ton/hr as determined by § 60.195(e).

3. Part 60 is amended by adding Reference Method 14 to Appendix A as follows:

METHOD 14—DETERMINATION OF FLUORIDE EMISSIONS FROM POTROOM ROOF MONITORS OF PRIMARY ALUMINUM PLANTS

1. *Principle and applicability.*

1.1 *Principle.* Gaseous and particulate fluoride roof monitor emissions are drawn into a permanent sampling manifold through several large nozzles. The sample is transported from the sampling manifold to ground level through a duct. The gas in the duct is sampled using Method 13A or 13B—DETERMINATION OF TOTAL FLUORIDE EMISSIONS FROM STATIONARY SOURCES. Effluent velocity and volumetric flow rate are determined with anemometers permanently located in the roof monitor.

1.2 *Applicability.* This method is applicable for the determination of fluoride emissions from stationary sources only when specified by the test procedures for determining compliance with new source performance standards.

2. *Apparatus.*

2.1.1 *Anemometers.* Vane or propeller anemometers with a velocity measuring threshold as low as 15 meters/minute and a range up to at least 600 meters/minute. Each anemometer shall generate an electrical signal which can be calibrated to the velocity measured by the anemometer. Anemometers shall be able to withstand dusty and corrosive atmospheres.

One anemometer shall be installed for every 85 meters of roof monitor length. If the roof monitor length divided by 85 meters is not a whole number, round the fraction to the nearest whole number to determine the number of anemometers needed. Use one anemometer for any roof monitor less than 85 meters long. Permanently mount the anemometers at the center of each equal length along the roof monitor. One anemometer shall be installed in the same section of the roof monitor that contains the sampling manifold (see section 2.2.1). Make a velocity traverse of the width of the roof monitor where an anemometer is to be placed. This traverse may be made with any suitable low velocity measuring device, and shall be made during normal process operating conditions. Install the anemometer at a point of average velocity along this traverse.

2.1.2 *Recorders.* Recorders equipped with signal transducers for converting the electrical signal from each anemometer to a continuous recording of air flow velocity, or to an integrated measure of volumetric flow. For the purpose of recording velocity, "continuous" shall mean one readout per 15-minute or shorter time interval. A constant amount of time shall elapse between readings. Volumetric flow rate may be determined by an electrical count of anemometer revolutions. The recorders or counters shall permit identification of the velocities or flow rate measured by each individual anemometer.

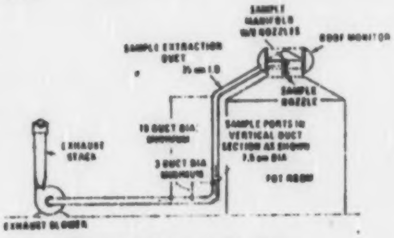

Figure 14-1. Roof Monitor Sampling System

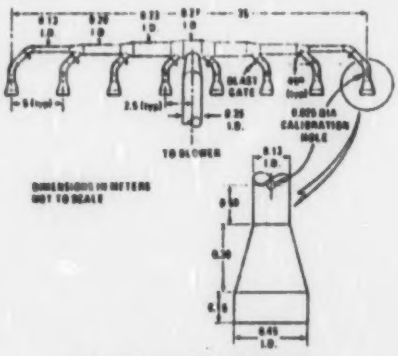

Figure 14-2. Sampling Manifold and Nozzles

2.2 Roof monitor air sampling system.

2.2.1 *Sampling ductwork.* The manifold system and connecting duct shall be permanently installed to draw an air sample from the roof monitor to ground level. A typical installation of duct for drawing a sample from a roof monitor to ground level is shown in Figure 14-1. A plan of a manifold system that is located in a roof monitor is shown in Figure 14-2. These drawings represent a typical installation for a generalized roof monitor. The dimensions on these figures may be altered slightly to make the manifold system fit into a particular roof monitor, but the general configuration shall be followed. There shall be eight nozzles, each having a diameter of 0.40 to 0.50 meters. The length of the manifold system from the first nozzle to the eighth shall be 35 meters or eight percent of the length of the roof monitor, whichever is greater. The duct leading from the roof monitor manifold shall be round with a diameter of 0.30 to 0.40 meters. As shown in Figure 14-2, each of the sample legs of the manifold shall have a device, such as a blast gate or valve, to enable adjustment of flow into each sample nozzle.

Locate the manifold along the length of the roof monitor so that it lies near the midsection of the roof monitor. If the design of a particular roof monitor makes this impossible, the manifold may be located elsewhere along the roof monitor, but avoid locating the manifold near the ends of the roof monitor or in a section where the aluminum reduction pot arrangement is not typical of the rest of the potroom. Center the sample nozzles in the throat of the roof monitor. (See Figure 14-1.) Construct all sample-exposed surfaces within the nozzles, manifold and sample duct of 316 stainless steel. Aluminum may be used if a new ductwork system is conditioned with fluoride-laden roof monitor air for a period of six weeks prior to initial testing. Other materials of construction may be used if it is demonstrated through comparative testing that there is no loss of fluorides in the system. All connections in the ductwork shall be leak free.

Locate two sample ports in a vertical section of the duct between the roof monitor and exhaust fan. The sample ports shall be at least 10 duct diameters downstream and two diameters upstream from any flow disturbance such as a bend or contraction. The two sample ports shall be situated 90° apart. One of the sample ports shall be situated so that the duct can be traversed in the plane of the nearest upstream duct bend.

2.2.2 *Exhaust fan*. An industrial fan or blower to be attached to the sample duct at ground level. (See Figure 14-1.) This exhaust fan shall have a maximum capacity such that a large enough volume of air can be pulled through the ductwork to maintain an isokinetic sampling rate in all the sample nozzles for all flow rates normally encountered in the roof monitor.

The exhaust fan volumetric flow rate shall be adjustable so that the roof monitor air can be drawn isokinetically into the sample nozzles. This control of flow may be achieved by a damper on the inlet to the exhauster or by any other workable method.

2.3 Temperature measurement apparatus.

2.3.1 *Thermocouple*. Installed in the roof monitor near the sample duct.

2.3.2 *Signal transducer*. Transducer to change the thermocouple voltage output to a temperature readout.

2.3.3 *Thermocouple wire*. To reach from roof monitor to signal transducer and recorder.

2.3.4 *Sampling train*. Use the train described in Methods 13A and 13B—Determination of total fluoride emissions from stationary sources.

3. Reagents.

3.1 *Sampling and analysis*. Use reagents described in Method 13A or 13B—Determination of total fluoride emissions from stationary sources.

4. Calibration.

4.1 *Propeller anemometer*. Calibrate the anemometers so that their electrical signal output corresponds to the velocity or volumetric flow they are measuring. Calibrate according to manufacturer's instructions.

4.2 *Manifold intake nozzles*. Adjust the exhaust fan to draw a volumetric flow rate (refer to Equation 14-1) such that the entrance velocity into each manifold nozzle approximates the average effluent velocity in the roof monitor. Measure the velocity of the air entering each nozzle by inserting an S type pitot tube into a 2.5 cm or less diameter hole (see Figure 14-2) located in the manifold between each blast gate (or valve) and nozzle. The pitot tube tip shall be extended into the center of the manifold. Take care to insure that there is no leakage around the pitot probe which could affect the indicated velocity in the manifold leg. If the velocity of air being drawn into each nozzle is not the same, open or close each blast gate (or valve) until the velocity in each nozzle is the same. Fasten each blast gate (or valve) so that it will remain in this position and close the pitot port holes. This calibration shall be performed when the manifold system is installed. (Note: It is recommended that this calibration be repeated at least once a year.)

5. Procedure.

5.1 *Roof monitor velocity determination*.

5.1.1 *Velocity value for setting isokinetic flow*. During the 24 hours preceding a test run, determine the velocity indicated by the propeller anemometer in the section of roof monitor containing the sampling manifold. Velocity readings shall be taken every 15 minutes or at shorter equal time intervals. Calculate the average velocity for the 24-hour period.

5.1.2 *Velocity determination during a test run*. During the actual test run, record the velocity or volume readings of each propeller anemometer in the roof monitor. Velocity readings shall be taken for each anemometer every 15 minutes or at shorter equal time intervals (or continuously).

5.2 *Temperature recording*. Record the temperature of the roof monitor every two hours during the test run.

5.3 *Sampling*.

5.3.1 *Preliminary air flow in duct*. During the 24 hours preceding the test, turn on the exhaust fan and draw roof monitor air through the manifold duct to condition the ductwork. Adjust the fan to draw a volumetric flow through the duct such that the velocity of gas entering the manifold nozzles approximates the average velocity of the air leaving the roof monitor.

5.3.2 *Isokinetic sample rate adjustment*. Adjust the fan so that the volumetric flow rate in the duct is such that air enters into the manifold sample nozzles at a velocity equal to the 24-hour average velocity determined under 5.1.1. Equation 14-1 gives the correct stream velocity which is needed in the duct at the sample ports in order for sample gas to be drawn isokinetically into the manifold nozzles. Perform a pitot traverse of the duct at the sample ports to determine if the correct average velocity in the duct has been achieved. Perform the pitot determination according to Method 2. Make this determination before the start of a test run. The fan setting need not be changed during the run.

$$V_d = \frac{8\,(D_n)^2}{(D_d)^2}\,(V_m)\,\frac{1\ \text{minute}}{60\ \text{sec}}$$

where:

V_d=desired velocity in duct at sample ports, meter/sec.

D_n=diameter of a roof monitor manifold nozzle, meters.

D_d=diameter of duct at sample port, meters.

V_m=average velocity of the air stream in the roof monitor, meters/minute, as determined under section 5.1.1.

5.2.3 *Sample train operation*. Sample the duct using the standard fluoride train and methods described in Methods 13A and 13B—Determination of total fluoride emissions from stationary sources. Select sample traverse points according to Method 1. If a selected sampling point is less than one inch from the stack wall, adjust the location of that point to one inch away from the wall.

5.3.4 *Each test run shall last eight hours or more*. If a question exists concerning the representativeness of an eight-hour test, a longer test period up to 24 hours may be selected. Conduct each run during a period when all normal operations are performed underneath the sampling manifold, i.e. tapping, anode changes, maintenance, and other normal duties. All pots in the potroom shall be operated in a normal manner during the test period.

5.3.5 *Sample recovery*. Same as Method 13A or 13B—Determination of total fluoride emissions from stationary sources.

5.4 *Analysis*. Same as Method 13A or 13B—Determination of total fluoride emissions from stationary sources.

6. Calculations.

6.1 *Isokinetic sampling test*. Calculate the mean velocity measured during each sampling run by the anemometer in the section of the roof monitor containing the sampling manifold. If the mean velocity recorded during a particular test run does not fall within ±20 percent of the mean velocity established according to 5.3.2, repeat the run.

6.2 *Average velocity of roof monitor gases*. Calculate the average roof monitor velocity using all the velocity or volumetric flow readings from section 5.1.2.

6.3 *Roof monitor temperature*. Calculate the mean value of the temperatures recorded in section 5.2.

6.4 *Concentration of fluorides in roof monitor air in mg F/m³*. This is given by Equation 13A-5 in Method 13A—Determination of total fluoride emissions from stationary sources.

6.5 Average volumetric flow from roof is given by Equation 14-2.

$$Q_m = \frac{V_{mt}\,(A)\,(M_d)\,P_m\,(294^\circ\text{K})}{(T_m + 273^\circ)\,(760\ \text{mm Hg})}$$

where:

Q_m=average volumetric flow from roof monitor at standard conditions on a dry basis, m³/min.

A=roof monitor open area, m².

V_{mt}=average velocity of air in the roof monitor, meters/minute, from section 6.2.

P_m=atmospheric pressure, mm Hg.

T_m=roof monitor temperature, °C, from section 6.3.

M_d=mole fraction of dry gas, which is given by $M_d = \frac{100 - 100\,(B_{ws})}{100}$

B_{ws} is the proportion by volume of water vapor in the gas stream, from Equation 13A-3, Method 13A—Determination of total fluoride emissions from stationary sources.

[Sections 111 and 114 of the Clean Air Act, as amended by section 4(a) of Pub. L. 91-604, 84 Stat. 1678 (42 U.S.C. 1857c-6, c-9)].

[FR Doc.76-2133 Filed 1-23-76;8:45 am]

28

Title 40—Protection of Environment

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

[FRL 483-7]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Delegation of Authority to Washington Local Agencies

Pursuant to section 111(c) of the Clean Air Act, as amended, the Regional Administrator of Region X, Environmental Protection Agency (EPA), delegated to the State of Washington Department of Ecology on February 28, 1975, the authority to implement and enforce the program for standards of performance for new stationary sources (NSPS). The delegation was announced in the FEDERAL REGISTER on April 1, 1975 (40 FR 14632). On April 25, 1975 (40 FR 18169) the Assistant Administrator for Air and Waste Management promulgated a change to 40 CFR 60.4, Address to reflect the delegation to the State of Washington.

On September 30 and October 8 and 9, 1975, the State Department of Ecology requested EPA's concurrence in the State's sub-delegation of the NSPS program to four local air pollution control agencies. After reviewing the State's request, the Regional Administrator determined that the subdelegations meet all the requirements outlined in EPA's delegation of February 28, 1975. Therefore, the Regional Administrator on December 5, 1975, concurred in the sub-delegations to the four local agencies listed below with the stipulation that all the conditions placed on the original delegation to the State shall also apply to the sub-delegations to the local agencies. EPA is today amending 40 CFR 60.4 to reflect the State's sub-delegations.

The amended § 60.4 provides that all reports, requests, applications, submittals and communications required pursuant to Part 60 which were previously to be sent to the Director of the State of Washington Department of Ecology (DOE) will now be sent to the Puget Sound Air Pollution Control Agency (PSAPCA), the Northwest Air Pollution Authority (NWAPA), the Spokane County Air Pollution Authority (SCAPA) or the Southwest Air Pollution Control Authority (SAPCA) as appropriate. The amended section is set forth below.

The Administrator finds good cause for foregoing prior public notice and for making this rulemaking effective immediately in that it is an administrative change and not one of substantive content. No additional substantive burdens are imposed on the parties affected. The delegations which are reflected by the administrative amendment were effective on September 30 to the NWAPA, October 7 to the PSAPCA and October 8 to the SCAPA and the SAPCA, and it serves no useful purpose to delay the technical change of the addition of the local agency addresses to the Code of Federal Regulations.

This rulemaking is effective immediately, and is issued under the authority of Section 111 of the Clean Air Act, as amended. 42 U.S.C. 1857c-6.

Dated: January 24, 1976.

STANLEY W. LEGRO,
Assistant Administrator for Enforcement.

Part 60 of Chapter I, Title 40 of the Code of Federal Regulations is amended as follows:

1. In § 60.4, paragraph (b) is amended by revising subparagraph (WW) to read as follows:

§ 60.4 Address.

* * * * *

(b) * * *

(WW) (i) Washington: State of Washington, Department of Ecology, Olympia, Washington 98504.

(ii) Northwest Air Pollution Authority, 207 Pioneer Building, Second and Pine Streets, Mount Vernon, Washington 98273.

(iii) Puget Sound Air Pollution Control Agency, 410 West Harrison Street, Seattle, Washington 98119.

(iv) Spokane County Air Pollution Control Authority, North 811 Jefferson, Spokane, Washington 99201.

(v) Southwest Air Pollution Control Authority, Suite 7601 H, NE Hazel Dell Avenue, Vancouver, Washington 98665.

* * * * *

[FR Doc.76-2673 Filed 1-28-76;8:45 am]

FEDERAL REGISTER, VOL. 41, NO. 20—
—THURSDAY, JANUARY 29, 1976

29

Title 40—Protection of Environment

[FRL 492-3]

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

SUBCHAPTER C—AIR PROGRAMS

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Delegation of Authority to State of Oregon

Pursuant to the delegation of authority for the standards of performance for new stationary sources (NSPS) to the State of Oregon on [illegible] 10, 1975, EPA is today amending 40 CFR 60.4, *Address*, to reflect this delegation. A Notice announcing this delegation is published today at 41 FR 7750 in the FEDERAL REGISTER. The amended § 60.4 which adds the address of the State of Oregon Department of Environmental Quality to which all reports, requests, applications, submittals, and communications pursuant to this part must be addressed, is set forth below.

The Administrator finds good cause for foregoing prior public notice and for making this rulemaking effective immediately in that it is an administrative change and not one of substantive content. No additional substantive burdens are imposed on the parties affected. The delegation which is reflected by this administrative amendment was effective on November 10, 1975 and it serves no purpose to delay the technical change of this addition of the State address to the Code of Federal Regulations.

This rulemaking is effective immediately, and is issued under the authority of Section 111 of the Clean Air Act, as amended. 42 U.S.C. 1857c-6.

Dated: February 11, 1976.

STANLEY W. LEGRO,
Assistant Administrator for Enforcement.

Part 60 of Chapter I, Title 40 of the Code of Federal Regulations is amended as follows:

1. In § 60.4 paragraph (b) is amended by revising subparagraph (MM) to read as follows:

§ 60.4 Address.

* * * * *

(b) * * *

(A)-(LL) * * *

(MM)—State of Oregon, Department of Environmental Quality, 1234 SW Morrison Street, Portland, Oregon 97205.

* * * * *

[FR Doc.76-4964 Filed 2-19-76;8:45 am]

FEDERAL REGISTER, VOL. 41, NO. 35—
—FRIDAY, FEBRUARY 20, 1976

30

Title 40—Protection of Environment

[FRL 494-3]

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

SUBCHAPTER C—AIR PROGRAMS

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Primary Copper, Zinc, and Lead Smelters; Correction

In FR Doc. 76-733 appearing at page 2331 in the FEDERAL REGISTER of January 15, 1976, the ninth line of paragraph (a) in § 60.165 is corrected to read as follows: "total smelter charge and the weight."

Dated: February 20, 1976.

ROGER STRELOW,
Assistant Administrator for Air and Waste Management.

[FR Doc.76-5398 Filed 2-25-76;8:45 am]

[FRL 495-4]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Delegation of Authority to Commonwealth of Virginia

Pursuant to the delegation of authority for the standards of performance for new stationary sources (NSPS) to the Commonwealth of Virginia on December 30, 1975, EPA is today amending 40 CFR 60.4, *Address*, to reflect this delegation. A Notice announcing this delegation is published today at 41 FR 8416 in the FEDERAL REGISTER. The amended § 60.4, which adds the address of the Virginia State Air Pollution Control Board to which all reports, requests, applications, submittals, and communications to the Administrator pursuant to this part must also be addressed, is set forth below.

The Administrator finds good cause for foregoing prior public notice and for making this rulemaking effective immediately in that it is an administrative change and not one of substantive content. No additional substantive burdens are imposed on the parties affected. The delegation which is reflected by this administrative amendment was effective on December 30, 1975, and it serves no purpose to delay the technical change of this addition of the State address to the Code of Federal Regulations.

This rulemaking is effective immediately, and is issued under the authority of section 111 of the Clean Air Act, as amended. 42 U.S.C. 1857c-6.

42 U.S.C. 1857c-6.

Dated: February 21, 1976.

STANLEY W. LEGRO,
Assistant Administrator for Enforcement.

Part 60 of Chapter I, Title 40 of the Code of Federal Regulations is amended as follows:

1. In § 60.4, paragraph (b) is amended by revising subparagraph (VV) to read as follows:

§ 60.4 Address.

* * * * *

(b) * * *

(A)-(UU) * * *

(VV) Commonwealth of Virginia, Virginia State Air Pollution Control Board, Room 1106, Ninth Street Office Building, Richmond, Virginia 23219.

[FR Doc.76-5504 Filed 2-25-76;8:45 am]

FEDERAL REGISTER, VOL. 41, NO. 39—THURSDAY, FEBRUARY 26, 1976

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SUBCHAPTER C—AIR PROGRAMS

[FRL 507-4]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCE

Delegation of Authority to State of Connecticut

Pursuant to the delegation of authority for the standards of performance for new stationary sources (NSPS) to the State of Connecticut on December 9, 1975, EPA is today amending 40 CFR 60.4, *Address*, to reflect this delegation. A Notice announcing this delegation is published today at (41 FR 11874) in the FEDERAL REGISTER. The amended § 60.4, which adds the address of the Connecticut Department of Environmental Protection to which all reports, requests, applications, submittals, and communications to the Administrator pursuant to this part must also be addressed, is set forth below.

The Administrator finds good cause for foregoing prior public notice and for making this rulemaking effective immediately in that it is an administrative change and not one of substantive content. No additional substantive burdens are imposed on the parties affected. The delegation which is reflected by this administrative amendment was effective on December 9, 1975, and it serves no purpose to delay the technical change of this addition to the State address to the Code of Federal Regulations.

This rulemaking is effective immediately, and is issued under the authority of section 111 of the Clean Air Act, as amended.

(42 U.S.C. 1857c-6)

Dated: March 15, 1976.

STANLEY W. LEGRO,
Assistant Administrator for Enforcement.

Part 60 of Chapter I, Title 40 of the Code of Federal Regulations is amended as follows:

1. In § 60.4 paragraph (b) is amended by revising subparagraph (H) to read as follows:

§ 60.4 Address.

* * * * *

(b) * * *

(H) State of Connecticut, Department of Environmental Protection, State Office Building, Hartford, Connecticut 06115.

* * * * *

[FR Doc.76-7906 Filed 3-19-76;8:45 am]

FEDERAL REGISTER, VOL. 41, NO. 56—MONDAY, MARCH 22, 1976

32

Title 40—Protection of Environment

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

[FRL 529-3]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCE

Delegation of Authority to State of South Dakota

Pursuant to the delegation of authority for the standards of performance for new stationary sources (NSPS) to the State of South Dakota on March 25, 1976, EPA is today amending 40 CFR 60.4, Address, to reflect this delegation. A Notice announcing this delegation is published today at 41 FR 17600. The amended § 60.4, which adds the address of Department of Environmental Protection to which all reports, requests, applications, submittals, and communications to the Administrator pursuant to this part must also be addressed, is set forth below.

The Administrator finds good cause for foregoing prior public notice and for making this rulemaking effective immediately in that it is an administrative change and not one of substantive content. No additional substantive burdens are imposed on the parties affected. The delegation which is reflected by this administrative amendment was effective on March 25, 1976, and it serves no purpose to delay the technical change of this addition of the State address to the Code of Federal Regulations.

This rulemaking is effective immediately, and is issued under the authority of Section 111 of the Clean Air Act, as amended.

42 U.S.C. 1857c-6.

Date: April 20, 1976.

STANLEY W. LEGRO,
Assistant Administrator for Enforcement.

Part 60 of Chapter I, Title 40 of the Code of Federal Regulations is amended as follows:

1. In § 60.4 paragraph (b) is amended by revising subparagraph QQ to read as follows:

§ 60.4 Address.

* *

(b) * * *

(A)-(Z) * * *

(AA)-(PP) * * *

(QQ) State of South Dakota, Department of Environmental Protection, Joe Foss Building, Pierre, South Dakota 57501.

FEDERAL REGISTER, VOL. 41, NO. 82—TUESDAY, APRIL 27, 1976

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Title 40—Protection of Environment

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

[FRL 509-3]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Ferroalloy Production Facilities

On October 21, 1974 (39 FR 37470), under section 111 of the Clean Air Act, as amended, the Environmental Protection Agency (EPA) proposed standards of performance for new and modified ferroalloy production facilities. Interested persons participated in the rulemaking by submitting comments to EPA. The comments have been carefully considered, and where determined by the Administrator to be appropriate, changes have been made to the regulations as promulgated.

The standards limit emissions of particulate matter and carbon monoxide from ferroalloy electric submerged arc furnaces. The purpose of the standards is to require effective capture and control of emissions from the furnace and tapping station by application of best systems of emission reduction. For ferroalloy furnaces the best system of emission reduction for particulate matter is a well-designed hood in combination with a fabric filter collector or venturi scrubber. For some alloys the best system is an electrostatic precipitator preceded by wet gas conditioning or a venturi scrubber. The standard for carbon monoxide requires only that the gas stream be flared or combusted in some other manner.

The environmental impact of these standards is beneficial since the increase in emissions due to growth of the industry will be minimized. Also, the standards will remove the incentive for plants to locate in areas with less stringent regulations.

Upon evaluation of the costs associated with the standards and their economic impact, EPA concluded that the costs are reasonable and should not bar entry into the market or expansion of facilities. In addition, the standards will require at most a minimal increase in power consumption over that required to comply with the restrictions of most State regulations.

SUMMARY OF REGULATION

The promulgated standards limit particulate matter and carbon monoxide emissions from the electric submerged arc furnace and limit particulate matter emissions from dust-handling equipment. Emissions of particulate matter from the control device are limited to less than 0.45 kg/MW-hr (0.99 lb/MW-hr) for furnaces producing high-silicon alloys (in general) and to less than 0.23 kg/MW-hr (0.51 lb/MW-hr) for furnaces producing chrome and manganese alloys. For both product groups, emissions from the control device must be less than 15 percent opacity. The regulation requires that the collection hoods capture all emissions generated within the furnace and capture all tapping emissions for at least 60 percent of the tapping time. The concentration of carbon monoxide in any gas stream discharged to the atmosphere must be less than 20 volume percent. Emissions from dust-handling equipment may not equal or exceed 10 percent opacity. Any owner or operator of a facility subject to this regulation must continuously monitor volumetric flow rates through the collection system and must continuously monitor the opacity of emissions from the control device.

SUMMARY OF COMMENTS

Eighteen comment letters were received on the proposed standards of performance. Copies of the comment letters and a report which contains a summary of the issues and EPA's responses are available for public inspection and copying at the U.S. Environmental Protection Agency, Public Information Reference Unit (EPA Library), Room 2922, 401 M Street, S.W., Washington, D.C. Copies of the report also may be obtained upon written request from the EPA Public Information Center (PM-215), 401 M Street, S.W., Washington, D.C. 20460 (specify—Supplemental Information on Standards of Performance for Ferroalloy Production Facilities). In addition to the summary of the issues and EPA's responses, the report contains a reevaluation of the opacity standard in light of revisions to Reference Method 9 which were published in the FEDERAL REGISTER November 12, 1974 (39 FR 39872).

The bases for the proposed standards are presented in "Background Information for Standards of Performance: Electric Submerged Arc Furnaces for Production of Ferroalloys" (EPA 450/2-74-018a, b). Copies of this document are available on request from the Emission Standards and Engineering Division, Environmental Protection Agency, Research Triangle Park, North Carolina 27711, Attention: Mr. Don R. Goodwin.

SIGNIFICANT COMMENTS AND CHANGES TO THE PROPOSED REGULATION

Most of the comment letters contained multiple comments. The more significant comments and the differences between the proposed and the final regulations are discussed below. In addition to the discussed changes, several paragraphs were reworded and some sections were reorganized.

(1) *Mass standard*. Several commenters questioned the representativeness of the data used to demonstrate the achievability of the 0.23 kg/MW-hr (0.51 lb/MW-hr) standard proposed for facilities producing chrome and manganese alloys. Specifically, the commenters were concerned that sampling only a limited number of compartments or control devices serving a furnace, nonisokinetic sampling of some facilities, and the procedures used to determine the total gas volume flow from open fabric filter collectors would bias the data low. For these reasons, the commenters argued that the standard should be 0.45 kg/MW-hr (0.99 lb/MW-hr) for all alloys. As additional support for their position, they claimed that control equipment vendors will not guarantee that their equipment will achieve 0.23 kg/MW-hr (0.51 lb/MW-hr).[35]

Because of these comments, EPA thoroughly reevaluated the bases for the two mass standards of performance and concluded that the standards are achievable by best systems of emission reduction. For open ferroalloy electric submerged arc furnaces, the best system of emission reduction is a well-designed canopy hood that minimizes the volume of induced air and a well-designed and properly operated fabric filter collector or high-energy venturi scrubber. In a few cases, an electrostatic precipitator preceded by a venturi scrubber or wet gas conditioning is a best system. In EPA's opinion, revising the standard upward to 0.45 kg/MW-hr (0.99 lb/MW-hr) would allow installation of systems other than the best. Therefore, the promulgated standard of performance for furnaces producing chrome and manganese alloys is 0.23 kg/MW-hr (0.51 lb/MW-hr). The standard for furnaces producing the specified high-silicon alloys is 0.45 kg/MW-hr (0.99 lb/MW-hr). The rationale for establishing the standards at these levels is summarized below.

The reevaluation of the data bases for the standards showed that the emission test procedures used did not significantly bias the results. Therefore, contrary to the commenter's concerns, the procedures did not result in emission limitations lower than those achievable by best systems of emission reduction. The deviations and assumptions made in the test procedures were based on consideration of the particle size of the emissions, an evaluation of the performance of the control systems, and factors affecting the induction of air into open fabric filter collectors.

EPA tests, and allows testing of, a representative number of stacks or compartments in a control device because subsections of a well-designed and properly operating control device will perform equivalently. Evaluation of the control system and the condition of the control device by EPA engineers at the time of the emission test showed that sections not tested were of equivalent design and in operating condition equivalent to or better than the tested sections. Thus, the performance of the non-tested portions of the control device are considered to be equivalent to or better than the performance of the sections emission tested. In addition, the particle size of emissions from well-controlled ferroalloy furnaces was investigated by EPA and was found to consist of particles of less than two micrometers aerodynamic diameter for all alloys. The mass and, hence, inertia of these particles are negligible; therefore, they follow the motion of the gas stream. For emissions of this size distribution, concentrations determined by nonisokinetic sampling would not be significantly different than those measured by isokinetic sampling.

EPA determined the total gas volume flow rate from the open fabric filter collectors by measuring the inlet volume flow rate and the volume of air induced into the collector. The inlet gas volumes to the collectors were measured during each run of each test; but the volume of air induced into the collector was determined once during the emission test. The total gas volume flow from the collector was calculated as the sum of the inlet gas volume and the induced air volume. Although the procedures used were not ideal, the reported gas volumes are considered to be reasonably representative of the total gas volumes from the facility. This conclusion is based on the fact that the quantity of air induced around the bags in an open collector is primarily dependent on the open area and the temperature of the inlet gas stream and the ambient air. Therefore, equivalent air volumes are drawn into the collector under similar meteorological and inlet gas conditions. During the periods of emission testing at the facilities, meteorological conditions were uniform and the volume of induced air was expected to be constant. Consequently, measurement of the induced air volume once during the emission test was expected to be sufficient for calculating the total gas volume flow from the collector.

Since conducting the test in question, EPA has gained additional experience and has concluded that in general it is preferable to measure the total gas volume flow during each run of a performance test. This conclusion, however, does not invalidate the use of the test data obtained by the less optimum procedure of a single determination of induced air volume. EPA evaluated possible variations in the amount of air induced into the collector by performing enthalpy balances using reported temperature data. The induced air volumes were calculated assuming adiabatic mixing (no heat transfer by inlet gases to collector) and, hence, are conservatively high estimates. The calculated induced air volumes did differ from the single measured values; however, the effect on the mass emission rate for the collectors was not significant. EPA, therefore, concluded that the use of single measurements of the induced air volume did not affect the level of the standards.

Another issue of concern to commenters is the reluctance of control equipment vendors to guarantee reduction of emissions to less than 0.23 kg/MW-hr (0.51 lb/MW-hr). It is EPA's opinion that this reluctance does not demonstrate the unachievability of the standard. The vendors' reluctance to guarantee this level is not surprising considering the variables which are beyond their control. Specifically, they rarely have any control over the design of the fume collection systems for the furnace and tapping station. Fabric filter collectors tend to control the concentration of particulate matter in the effluent. The mass rate of emissions from the collector is determined by the total volumetric flow rate from the control device, which is not determined by vendors. Further, because of limited experience with emission testing to evaluate the performance of open fabric filter collectors, vendors cannot effectively evaluate the performance of these systems over the guarantee period. For vendors, establishment of the performance guarantee level is also complicated by the fact that the performance of the collector is contingent upon its being properly operated and maintained.

Standards of performance are necessarily based on data from a limited number of best-controlled facilities and on engineering judgments regarding performance of the control systems. For this reason, there is a possibility of arriving at different conclusions regarding the performance capabilities of these systems. Consequently, the question of vendors' reluctance to guarantee their equipment to achieve 0.23 kg/MW-hr (0.51 lb/MW-hr) was considered along with the results of additional recent emission tests on fabric filter collectors. Recognizing that the data base for the standards was limited and that a number of well-controlled facilities had started operation since completion of the original study, EPA obtained additional data to better evaluate the performance of emission control systems of interest. Under the authority of section 114 of the Clean Air Act, EPA requested copies of all emission data for well-controlled furnaces operated by 10 ferroalloy producers. Data were received for five well-controlled facilities. In general, these facilities had close fitting water cooled canopy hoods, and tapping fumes were collected and sent to the control device along with the furnace emissions.

The emission data submitted by the industry show that properly operating compartments of open fabric filter collectors have effluent concentrations of less than 0.009 g/dscm (0.004 gr/dscf). For these recently constructed facilities, the reported mass emission rates were less than 0.12 kg/MW-hr (0.24 lb/MW-hr) for 15 MW capacity silicon metal furnaces. Evaluation of possible errors in the data and uncertainties in the test procedures showed that emissions may have been as high as 0.20 kg/MW-hr (0.45 lb/MW-hr) in some cases. These emission rates were achieved by design of the collection hood to minimize the quantity of induced air. The data submitted by the industry showed that gas volumes from well-hooded large silicon metal furnaces can be reduced to 50 percent of the volumes from typically hooded large silicon furnaces. Based on the data obtained from the industry, a large well-hooded and well-controlled silicon metal furnace is expected to have an emission rate of less than 0.45 kg/MW-hr (0.99 lb/MW-hr).

In EPA's study of the ferroalloy industry, it was determined that emissions from production of high-silicon alloys would be more difficult to control than chrome and manganese emissions due to the finer size distribution of the particles and significantly larger gas volumes from the furnace. Comparison of the gas volumes reported by the industry from silicon metal production with gas volumes from typically hooded furnaces producing chrome and manganese alloys shows that the original conclusion is still valid. Due to the lower gas volumes associated with their production, a lower mass emission rate is still expected for chrome and manganese alloys. In addition, EPA emission tests in the original study on a number of tightly hooded open furnaces demonstrated emissions can be controlled to less than 0.23 kg/MW-hr (0.51 lb/MW-hr). Emissions were reduced to these levels by control of induced air volumes and by use of a well-designed and properly operated fabric filter collector or venturi scrubber.

Just before promulgation of the standards, members of the Ferroalloy Association informed EPA that future supplies of chrome and manganese ores will be finer and more friable than those in use during development of the standard. The industry representatives claimed that use of finer ores will affect furnace operations and prevent new furnaces from complying with the 0.23 kg/MW-hr (0.51 lb/MW-hr) standard. Although the representatives submitted statements concerning the effect of finer ores on furnace operating conditions, no data were provided to show the effect of ore size on emissions. EPA evaluated the material submitted and concluded that furnace operating problems associated with use of fine ores can be controlled by operation and maintenance procedures. With proper operation of the furnace, use of finer ores should not affect the achievability of the standard, and relaxation of the 0.23 kg/MW-hr (0.51 lb/MW-hr) standard is not justified. This evaluation is discussed in detail in Chapter II of the supplemental information document. If and when factual information is presented to EPA which clearly demonstrates that use of finer chrome and manganese ores does prevent a properly operated new furnace, which is equipped with the best demonstrated system of emission reduction (considering costs), from meeting the 0.23 kg/MW-hr (0.51 lb/MW-hr) standard, EPA will propose a revision to the standard. The best system of emission reduction (considering costs) is considered to be a well-designed collection hood in combination with a well-designed fabric filter collector or high-energy venturi scrubber

The emission data obtained by EPA and the data provided by the industry show that the standards of performance for both product groups are achievable and the required control system clearly is adequately demonstrated. The question of the achievability of and the validity of the data basis for both the 0.23 kg/MW-hr (0.51 lb/MW-hr) and 0.45 kg/MW-hr (0.99 lb/MW-hr) standards is discussed in more detail in Chapter II of the supplemental information document.

(2) *Control device opacity standard.* On November 12, 1974 (39 FR 39872), after proposal of the standards for ferroalloy facilities, Method 9 was revised to require that compliance with opacity standards be determined by averaging sets of 24 consecutive observations taken at 15-second intervals (six-minute averages). The proposed opacity standard which limited emissions from the control

device to less than 20 percent has been revised in the regulation promulgated herein to require that emissions be less than 15 percent opacity in order to retain the intended level of control.

(3) *Control system capture requirements.* Ten commenters criticized fume capture requirements for the furnace and tapping station control systems on two basic points. The arguments were: (1) EPA lacks the statutory authority to regulate emissions within the building, and (2) the standards are not technically feasible at all times.

EPA has the statutory authority under section 111 of the Act to regulate any new stationary source which "emits or may emit any air pollutant." EPA does not agree with the opinion of the commenters that section 111 of the Act expressly or implicitly limits the Agency to regulation only of pollutants which are emitted directly into the atmosphere. Particulate matter emissions escaping capture by the furnace control system ultimately will be discharged to the atmosphere outside of the shop; therefore, they may be regulated under section 111 of the Act. Standards which regulate pollutants at the point of emission inside the building allow assessment of the control system without interference from nonregulated sources located in the same building. In addition, by requiring evaluation of emissions before their dilution, the standards will result in better control of the furnace emissions and will regulate affected ferroalloy facilities more uniformly than would standards limiting emissions from the shop.

EPA believes the standards on the furnace and tapping station collection hoods are achievable because the standards are based on observations of normal operations at well-controlled facilities. The commenters who argued that the standards are not technically feasible at all times cited examples of abnormal operations which would preclude achieving the standards. For example, several commenters cited the fact that violent reactions due to imbalances in the alloy chemistry occasionally can generate more emissions than the hood was designed to capture. If the capture system is well-designed, well-maintained, and properly operated, only failures of the process to operate in the normal or usual manner would cause the capacity of the system to be exceeded. Such operating periods are malfunctions, and, therefore, compliance with the standards of performance would not be determined during these periods. Performance tests under 40 CFR 60.8(c) are conducted only during representative conditions, and periods of start-up, shutdown, and malfunctions are not considered representative conditions.

Five commenters discussed other operating conditions which they believed would preclude a source from complying with the tapping station standard. These conditions included blowing taps, period of poling the taphole, and periods of removal of metal and slag from the spout. The commenters argued that blowing taps should be exempted from the standard and the tapping station standard should be replaced with an opacity standard or emissions from the shop. The comments were reviewed and EPA concluded that exemption of blowing taps is justified. The regulation promulgated herein exempts blowing taps from the tapping station standard and includes a definition of blowing tap. EPA believes that conditions which result in plugging of the taphole and metal in the spout are malfunctions because they are unavoidable failures of the process to operate in the normal or usual manner. Discussions with experts in the ferroalloy industry, revealed that these conditions are not predictable conditions for which a preventative maintenance or operation program could be established. As malfunctions, these periods are not subject to the standards, and a performance test would not be conducted during such periods. Therefore, the suggested revision to the standard to exempt these periods is not necessary because of the existing provisions of 40 CFR 60.8(c) and 60.11. In EPA's judgment, both the furnace and tapping station standards are achievable for all normal process operations at facilities with well-designed, well-maintained, and properly operated emission collection systems.

The promulgated regulation retains the proposed fume capture requirements, but the regulation has been revised to be more enforceable than the proposed capture requirements, which could have been enforced only on an infrequent basis. The regulation has been reorganized to clarify that unlike the opacity standards, the collection system capture requirements (visible emission limitations) are subject to demonstration of compliance during the performance test. To provide a means for routine enforcement of the capture requirements, continuous monitoring of the volumetric flow rate(s) through the collection system is required for each affected furnace. An owner or operator may comply with this requirement either by installing a flow rate monitoring device in an appropriate location in the exhaust duct or by calculating the flow rate through the system from fan operating data. During the performance test, the baseline operating flow rate(s) will be established for the affected electric submerged arc furnace. The regulation establishes emission capture standards which are applicable only during the performance test of the affected facility. At all other times, the operating volumetric flow rate(s) shall be maintained at or greater than the established baseline values for the furnace load. Use of lower volumetric flow rates than the established values constitutes unacceptable operation and maintenance of the affected facility. These provisions of the promulgated regulation will ensure continuous monitoring of the operations of the emission capture system and will simplify enforcement of the emission capture requirements.

The requirements for monitoring volumetric flow rates will add negligible additional costs to the total costs of complying with the standards of performance. Flow rate monitoring devices of sufficient accuracy to meet the requirements of § 60.265(c) can be installed for $600–$4000 depending on the flow profile of the area being monitored and the complexity of the monitoring device. A suitable strip chart recorder can be installed for less than $600. The alternative provisions allowing calculation of the volumetric flow rate(s) through the control system from continuous monitoring of fan operations will result in no additional costs because the industry presently monitors fan operations.

(4) *Monitoring of operations.* The promulgated regulation requires reporting to the Administrator any product changes that will result in a change in the applicable standard of performance for the affected electric submerged arc furnace. This requirement is necessary because electric submerged arc furnaces may be converted to production of alloys other than the original design alloys by physical alterations to the furnace, changes to the electrode spacing, changes in the transformer capacity, and changes in the materials charged to the furnace. Thus, the emission rate from the electric submerged arc furnace and the standard of performance (which is dependent on the alloy produced) may change during the lifetime of the facility. Conversion of the furnace to production of alloys with significantly different emission rates, such as changes between the product groups for the two standards, may result in the facility exceeding the applicable standard. Consequently, the reporting requirement was added to ensure continued compliance with the applicable standards of performance. These reports of product changes will afford the Administrator an opportunity to determine whether a performance test should be conducted and will simplify enforcement of the regulation. As with the requirements applicable under the proposed regulation, the performance test still must be conducted while the electric submerged arc furnace is producing the design alloy whose emissions are the most difficult to control of the product family. Subsequent product changes within the product family will not cause the facility to exceed the standard.

(5) *Test methods and procedures.* Section 60.266(d) of the promulgated regulation requires the owner or operator to design and construct the control device to allow measurement of emissions and flow rates using applicable test methods and procedures. This provision permits the use of open pressurized fabric filter collectors (and other control devices) whose emissions cannot be measured by reference methods currently in Appendix A to this part, if compliance with the promulgated standard can be demonstrated by an alternative procedure. EPA has not specified a single test procedure for emission testing of open pressurized fabric filter collectors because of the large variations in the design of these collectors. Test procedures can be developed on a case-by-case basis, however. Provisions in 40 CFR 60.8(b) allow the owner or operator upon approval by the Administrator to use an "alternative" or

"equivalent" test procedure to show compliance with the standards. EPA would like to emphasize that development of the "alternative" or "equivalent" test procedure is the responsibility of any owner or operator who elects to use a control device not amenable to testing by Method 5 of Appendix A to this part. The procedures of an "alternative" test method for demonstration of compliance are dependent on specific design features and condition of the collector and the capabilities of the sampling equipment. Consequently, procedures acceptable for demonstration of compliance will vary with specific situations. General guidance on possible approaches to sampling of emissions from pressurized fabric filter collectors is provided in Chapter IV of the supplemental information document.

Due to the costs of testing, the owner or operator should obtain EPA approval for a specific test procedure or other means for determining compliance before construction of a new source. Under the provisions of § 60 6, the owner or operator of a new facility may request review of the acceptability of proposed plans for construction and testing of control systems which are not amenable to sampling by Reference Method 5. If an acceptable "alternative" test procedure is not developed by the owner or operator, then total enclosure of the pressurized fabric filter collector and testing by Method 5 is required.

Effective date. In accordance with section 111 of the Act, these regulations prescribing standards of performance for ferroalloy production facilities are effective May 4, 1976, and apply to electric submerged arc furnaces and their associated dust-handling equipment, the construction or modification of which was commenced after October 21, 1974.

(Secs. 111 and 114 of the Clean Air Act, amended by Sec. 4(a) of Pub. L. 91-604, 84 Stat. 1678 (42 U.S.C. 1857c-6, 1857c-9).)

Dated: April 23, 1976.

RUSSELL E. TRAIN,
Administrator.

Part 60 of Chapter I, Title 40 of the Code of Federal Regulations is amended as follows:

1. The table of sections is amended by adding subpart Z as follows:

Subpart Z—Standards of Performance for Ferroalloy Production Facilities

Sec.
60.260 Applicability and designation of affected facility.
60.261 Definitions.
60.262 Standard for particulate matter.
60.263 Standard for carbon monoxide.
60.264 Emission monitoring.
60.265 Monitoring of operations.
60.266 Test methods and procedures.

2. Part 60 is amended by adding subpart Z as follows:

Subpart Z—Standards of Performance for Ferroalloy Production

§ 60.260 Applicability and designation of affected facility.

The provisions of this subpart are applicable to the following affected facilities: Electric submerged arc furnaces which produce silicon metal, ferrosilicon, calcium silicon, silicomanganese zirconium, ferrochrome silicon, silvery iron, high-carbon ferrochrome, charge chrome standard ferromanganese, silimanganese, ferromanganese silicon, or calcium carbide; and dust-handling equipment.

§ 60.261 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in subpart A of this part.

(a) "Electric submerged arc furnace" means any furnace wherein electrical energy is converted to heat energy by transmission of current between electrodes partially submerged in the furnace charge.

(b) "Furnace charge" means any material introduced into the electric submerged arc furnace and may consist of, but is not limited to, ores, slag, carbonaceous material, and limestone.

(c) "Product change" means any change in the composition of the furnace charge that would cause the electric submerged arc furnace to become subject to a different mass standard applicable under this subpart.

(d) "Slag" means the more or less completely fused and vitrified matter separated during the reduction of a metal from it's ore.

(e) "Tapping" means the removal of slag or product from the electric submerged arc furnace under normal operating conditions such as removal of metal under normal pressure and movement by gravity down the spout into the ladle.

(f) "Tapping period" means the time duration from initiation of the process of opening the tap hole until plugging of the tap hole is complete.

(g) "Furnace cycle" means the time period from completion of a furnace product tap to the completion of the next consecutive product tap.

(h) "Tapping station" means that general area where molten product or slag is removed from the electric submerged arc furnace.

(i) "Blowing tap" means any tap in which an evaluation of gas forces or projects jets of flame or metal sparks beyond the ladle, runner, or collection hood.

(j) "Furnace power input" means the resistive electrical power consumption of an electric submerged arc furnace as measured in kilowatts.

(k) "Dust-handling equipment" means any equipment used to handle particulate matter collected by the air pollution control device (and located at or near such device) serving any electric submerged arc furnace subject to this subpart.

(l) "Control device" means the air pollution control equipment used to remove particulate matter generated by an electric submerged arc furnace from an effluent gas stream.

(m) "Capture system" means the equipment (including hoods, ducts, fans, dampers, etc.) used to capture or transport particulate matter generated by an affected electric submerged arc furnace to the control device.

(n) "Standard ferromanganese" means that alloy as defined by A.S.T.M. designation A99-66.

(o) "Silicomanganese" means that alloy as defined by A.S.T.M. designation A483-66.

(p) "Calcium carbide" means material containing 70 to 85 percent calcium carbide by weight.

(q) "High-carbon ferrochrome" means that alloy as defined by A.S.T.M. designation A101-66 grades HC1 through HC6.

(r) "Charge chrome" means that alloy containing 52 to 70 percent by weight chromium, 5 to 8 percent by weight carbon, and 3 to 6 percent by weight silicon.

(s) "Silvery iron" means any ferrosilicon, as defined by A.S.T.M. designation 100-69, which contains less than 30 percent silicon.

(t) "Ferrochrome silicon" means that alloy as defined by A.S.T.M. designation A482-66.

(u) "Silicomanganese zirconium" means that alloy containing 60 to 65 percent by weight silicon, 1.5 to 2.5 percent by weight calcium, 5 to 7 percent by weight zirconium, 0.75 to 1.25 percent by weight aluminum, 5 to 7 percent by weight manganese, and 2 to 3 percent by weight barium.

(v) "Calcium silicon" means that alloy as defined by A.S.T.M. designation A495-64.

(w) "Ferrosilicon" means that alloy as defined by A.S.T.M. designation A100-69 grades A, B, C, D, and E which contains 50 or more percent by weight silicon.

(x) "Silicon metal" means any silicon alloy containing more than 96 percent silicon by weight.

(y) "Ferromanganese silicon" means that alloy containing 63 to 66 percent by weight manganese, 28 to 32 percent by weight silicon, and a maximum of 0.08 percent by weight carbon.

§ 60.262 Standard for particulate matter.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any electric submerged arc furnace any gases which:

(1) Exit from a control device and contain particulate matter in excess of 0.45 kg/MW-hr (0.99 lb/MW-hr) while silicon metal, ferrosilicon, calcium silicon, or silicomanganese zirconium is being produced.

(2) Exit from a control device and contain particulate matter in excess of 0.23 kg/MW-hr (0.51 lb/MW-hr) while high-carbon ferrochrome, charge chrome, standard ferromanganese, silicomanganese, calcium carbide, ferrochrome silicon, ferromanganese silicon, or silvery iron is being produced.

(3) Exit from a control device and exhibit 15 percent opacity or greater.

(4) Exit from an electric submerged arc furnace and escape the capture system and are visible without the aid of instruments. The requirements under this subparagraph apply only during periods when flow rates are being established under § 60.265(d).

(5) Escape the capture system at the tapping station and are visible without the aid of instruments for more than 40 percent of each tapping period. There are no limitations on visible emissions under this subparagraph when a blowing tap occurs. The requirements under this subparagraph apply only during periods when flow rates are being established under § 60.265(d).

(b) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any dust-handling equipment any gases which exhibit 10 percent opacity or greater.

§ 60.263 Standard for carbon monoxide.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any electric submerged arc furnace any gases which contain, on a dry basis, 20 or greater volume percent of carbon monoxide. Combustion of such gases under conditions acceptable to the Administrator constitutes compliance with this section. Acceptable conditions include, but are not limited to, flaring of gases or use of gases as fuel for other processes.

§ 60.264 Emission monitoring.

(a) The owner or operator subject to the provisions of this subpart shall install, calibrate, maintain and operate a continuous monitoring system for measurement of the opacity of emissions discharged into the atmosphere from the control device(s).

(b) For the purpose of reports required under § 60.7(c), the owner or operator shall report as excess emissions all six-minute periods in which the average opacity is 15 percent or greater.

(c) The owner or operator subject to the provisions of this subpart shall submit a written report of any product change to the Administrator. Reports of product changes must be postmarked not later than 30 days after implementation of the product change.

§ 60.265 Monitoring of operations.

(a) The owner or operator of any electric submerged arc furnace subject to the provisions of this subpart shall maintain daily records of the following information:

(1) Product being produced.

(2) Description of constituents of furnace charge, including the quantity, by weight.

(3) Time and duration of each tapping period and the identification of material tapped (slag or product.)

(4) All furnace power input data obtained under paragraph (b) of this section.

(5) All flow rate data obtained under paragraph (c) of this section or all fan motor power consumption and pressure drop data obtained under paragraph (e) of this section.

(b) The owner or operator subject to the provisions of this subpart shall install, calibrate, maintain, and operate a device to measure and continuously record the furnace power input. The furnace power input may be measured at the output or input side of the transformer. The device must have an accuracy of ±5 percent over its operating range.

(c) The owner or operator subject to the provisions of this subpart shall install, calibrate, and maintain a monitoring device that continuously measures and records the volumetric flow rate through each separately ducted hood of the capture system, except as provided under paragraph (e) of this section. The owner or operator of an electric submerged arc furnace that is equipped with a water cooled cover which is designed to contain and prevent escape of the generated gas and particulate matter shall monitor only the volumetric flow rate through the capture system for control of emissions from the tapping station. The owner or operator may install the monitoring device(s) in any appropriate location in the exhaust duct such that reproducible flow rate monitoring will result. The flow rate monitoring device must have an accuracy of ±10 percent over its normal operating range and must be calibrated according to the manufacturer's instructions. The Administrator may require the owner or operator to demonstrate the accuracy of the monitoring device relative to Methods 1 and 2 of Appendix A to this part.

(d) When performance tests are conducted under the provisions of § 60.8 of this part to demonstrate compliance with the standards under §§ 60.262(a) (4) and (5), the volumetric flow rate through each separately ducted hood of the capture system must be determined using the monitoring device required under paragraph (c) of this section. The volumetric flow rates must be determined for furnace power input levels at 50 and 100 percent of the nominal rated capacity of the electric submerged arc furnace. At all times the electric submerged arc furnace is operated, the owner or operator shall maintain the volumetric flow rate at or above the appropriate levels for that furnace power input level determined during the most recent performance test. If emissions due to tapping are captured and ducted separately from emissions of the electric submerged arc furnace, during each tapping period the owner or operator shall maintain the exhaust flow rates through the capture system over the tapping station at or above the levels established during the most recent performance test. Operation at lower flow rates may be considered by the Administrator to be unacceptable operation and maintenance of the affected facility. The owner or operator may request that these flow rates be reestablished by conducting new performance tests under § 60.8 of this part.

(e) The owner or operator may as an alternative to paragraph (c) of this section determine the volumetric flow rate through each fan of the capture system from the fan power consumption, pressure drop across the fan and the fan performance curve. Only data specific to the operation of the affected electric submerged arc furnace are acceptable for demonstration of compliance with the requirements of this paragraph. The owner or operator shall maintain on file a permanent record of the fan performance curve (prepared for a specific temperature) and shall:

(1) Install, calibrate, maintain, and operate a device to continuously measure and record the power consumption of the fan motor (measured in kilowatts), and

(2) Install, calibrate, maintain, and operate a device to continuously measure and record the pressure drop across the fan. The fan power consumption and pressure drop measurements must be synchronized to allow real time comparisons of the data. The monitoring devices must have an accuracy of ±5 percent over their normal operating ranges.

(f) The volumetric flow rate through each fan of the capture system must be determined from the fan power consumption, fan pressure drop, and fan performance curve specified under paragraph (e) of this section, during any performance test required under § 60.8 of this part to demonstrate compliance with the standards under §§ 60.262(a) (4) and (5). The owner or operator shall determine the volumetric flow rate at a representative temperature for furnace power input levels of 50 and 100 percent of the nominal rated capacity of the electric submerged arc furnace. At all times the electric submerged arc furnace is operated, the owner or operator shall maintain the fan power consumption and fan pressure drop at levels such that the volumetric flow rate is at or above the levels established during the most recent performance test for that furnace power input level. If emissions due to tapping are captured and ducted separately from emissions of the electric submerged arc furnace, during each tapping period the owner or operator shall maintain the fan power consumption and fan pressure drop at levels such that the volumetric flow rate is at or above the levels established during the most recent performance test. Operation at lower flow rates may be considered by the Administrator to be unacceptable operation and maintenance of the affected facility. The owner or operator may request that these flow rates be reestablished by conducting new performance tests under § 60.8 of this part. The Administrator may require the owner or operator to verify the fan performance curve by monitoring necessary fan operating parameters and determining the gas volume moved relative to Methods 1 and 2 of Appendix A to this part.

(g) All monitoring devices required under paragraphs (c) and (e) of this section are to be checked for calibration annually in accordance with the procedures under § 60.13(b).

§ 60.266 Test methods and procedures.

(a) Reference methods in Appendix A of this part, except as provided in § 60.8 (b), shall be used to determine compliance with the standards prescribed in § 60.262 and § 60.263 as follows:

(1) Method 5 for the concentration of particulate matter and the associated moisture content except that the heating systems specified in paragraphs 2.1.2 and 2.1.4 of Method 5 are not to be used when the carbon monoxide content of the gas stream exceeds 10 percent by volume, dry basis.

(2) Method 1 for sample and velocity traverses.

(3) Method 2 for velocity and volumetric flow rate.

(4) Method 3 for gas analysis, including carbon monoxide.

(b) For Method 5, the sampling time for each run is to include an integral number of furnace cycles. The sampling time for each run must be at least 60 minutes and the minimum sample volume must be 1.8 dscm (64 dscf) when sampling emissions from open electric submerged arc furnaces with wet scrubber control devices, sealed electric submerged arc furnaces, or semi-enclosed electric submerged arc furnaces. When sampling emissions from other types of installations, the sampling time for each run must be at least 200 minutes and the minimum sample volume must be 5.7 dscm (200 dscf). Shorter sampling times or smaller sampling volumes, when necessitated by process variables or other factors, may be approved by the Administrator.

(c) During the performance test, the owner or operator shall record the maximum open hood area (in hoods with segmented or otherwise moveable sides) under which the process is expected to be operated and remain in compliance with all standards. Any future operation of the hooding system with open areas in excess of the maximum is not permitted.

(d) The owner or operator shall construct the control device so that volumetric flow rates and particulate matter emissions can be accurately determined by applicable test methods and procedures.

(e) During any performance test required under § 60.8 of this part, the owner or operator shall not allow gaseous diluents to be added to the effluent gas stream after the fabric in an open pressurized fabric filter collector unless the total gas volume flow from the collector is accurately determined and considered in the determination of emissions.

(f) When compliance with § 60.263 is to be attained by combusting the gas stream in a flare, the location of the sampling site for particulate matter is to be upstream of the flare.

(g) For each run, particulate matter emissions, expressed in kg/hr (lb/hr), must be determined for each exhaust stream at which emissions are quantified using the following equation:

$$E_n = C_n Q_n$$

where:

E_n = Emissions of particulate matter in kg/hr (lb/hr).

C_n = Concentration of particulate matter in kg/dscm (lb/dscf) as determined by Method 5.

Q_n = Volumetric flow rate of the effluent gas stream in dscm/hr (dscf/hr) as determined by Method 2.

(h) For Method 5, particulate matter emissions from the affected facility, expressed in kg/MW-hr (lb/MW-hr) must be determined for each run using the following equation:

$$E = \frac{\sum_{n=1}^{N} E_n}{p}$$

where:

E = Emissions of particulate from the affected facility, in kg/MW-hr (lb/MW-hr).

N = Total number of exhaust streams at which emissions are quantified.

E_n = Emission of particulate matter from each exhaust stream in kg/hr (lb/hr), as determined in paragraph (g) of this section.

p = Average furnace power input during the sampling period, in megawatts as determined according to § 60.265 (b).

(Secs. 111 and 114 of the Clean Air Act, as amended by sec. 4(a) of Pub. L. 91-604, 84 Stat. 1678 (42 U.S.C. 1857c-6, 1857c-9))

[FR Doc.76-12814 Filed 5-3-76;8:45 am]

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Title 40—Protection of Environment

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

SUBCHAPTER C—AIR PROGRAMS

[FRL 539-6]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCE

Delegation of Authority to Commonwealth of Massachusetts

Pursuant to the delegation of authority for the standards of performance for new stationary sources (NSPS) to the Commonwealth of Massachusetts on January 23, 1976, EPA is today amending 40 CFR 60.4, "Address," to reflect this delegation. A notice announcing this delegation is published in the Notices section of today's FEDERAL REGISTER. The amended § 60.4, which adds the address of the Massachusetts Department of Environmental Quality Engineering, Division of Air Quality Control, to which all reports, requests, applications, submittals, and communications to the Administrator pursuant to this part must also be addressed, is set forth below.

The Administrator finds good cause for foregoing prior public notice and for making this rulemaking effective immediately in that it is an administrative change and not one of substantive content. No additional substantive burdens are imposed on the parties affected. The delegation which is reflected by this administrative amendment was effective on January 23, 1976, and it serves no purpose to delay the technical change of this addition of the State address to the Code of Federal Regulations.

This rulemaking is effective immediately, and is issued under the authority of Section 111 of the Clean Air Act, as amended.

42 U.S.C. 1857c-6.

Dated May 3, 1976.

STANLEY W. LEGRO,
Assistant Administrator for Enforcement.

Part 60 of Chapter I, Title 40 of the Code of Federal Regulations is amended as follows:

1. In § 60.4 paragraph (b) is amended by revising subparagraph (W) to read as follows:

§ 60.4 Address.

* * * * *

(b) * * *

(W) Massachusetts Department of Environmental Quality Engineering, Division of Air Quality Control, 600 Washington Street, Boston, Massachusetts 02111.

[FR Doc.76-13822 Filed 5-12-76;8:45 am]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Delegation of Authority to State of New Hampshire

Pursuant to the delegation of authority for the standards of performance for new stationary sources (NSPS) to the State of New Hampshire on February 17, 1976, EPA is today amending 40 CFR 60.4, "Address," to reflect this delegation. A Notice announcing this delegation is published in the Notices section of today's FEDERAL REGISTER. The amended § 60.4, which adds the address of the New Hampshire Air Pollution Control Agency to which all reports, requests, applications, submittals, and communications to the Administrator pursuant to this part must also be addressed, is set forth below.

The Administrator finds good cause for foregoing prior public notice and for making this rulemaking effective immediately in that it is an administrative change and not one of substantive content. No additional substantive burdens are imposed on the parties affected. The delegation which is reflected by this administrative amendment was effective on February 17, 1976, and it serves no purpose to delay the technical change of this addition of the State address to the Code of Federal Regulations.

This rulemaking is effective immediately, and is issued under the authority of Section 111 of the Clean Air Act, as amended.

42 U.S.C. 1857c-6.

Dated: May 3, 1976.

STANLEY W. LEGRO,
Assistant Administrator of Enforcement.

Part 60 of Chapter I, Title 40 of the Code of Federal Regulations is amended as follows:

1. In § 60.4 paragraph (b) is amended by revising subparagraph (EE) to read as follows:

§ 60.4 Address.

* * * * *

(b) * * *

(EE) New Hampshire Air Pollution Control Agency, Department of Health and Welfare, State Laboratory Building, Hazen Drive, Concord, New Hampshire 03301.

[FR Doc.76-13821 Filed 5-12-76;8:45 am]

FEDERAL REGISTER, VOL. 41, NO. 94—THURSDAY, MAY 13, 1976

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[FRL 509-8]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Ferroalloy Production Facilities

Correction

In FR Doc. 76-12514 appearing at page 18498 in the FEDERAL REGISTER of Tuesday, May 4, 1976 the following corrections should be made:

1. On page 18498, second column, last paragraph designated "(1)", second line, fourth word should read "representativeness".

2. On page 18501, first column, the subpart heading immediately preceding the text, should read "Subpart Z—Standards of Performance for Ferroalloy Production Facilities".

3. On page 18501, in § 60.260, second column, fourth line from the top, the third word should read "silicomanga-".

4. On page 18501, second column, in § 60.261 (i), second line, third word should read "evolution".

5. On page 18502, third column, in § 60.266(h) the equation should have appeared as follows:

$$E=\frac{\sum_{n=1}^{N}E_n}{P}$$

[OPP—260019; FRL 545-8]

FEDERAL REGISTER, VOL. 41, NO. 99—THURSDAY, MAY 20, 1976

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Title 40—Protection of Environment

[FRL 548-4]

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

SUBCHAPTER C—AIR PROGRAMS

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Delegation of Authority to State of California on Behalf of Ventura County and Northern Sonoma County Air Pollution Control Districts

Pursuant to the delegation of authority for the standards of performance for new stationary sources (NSPS) to the State of California on behalf of the Ventura County Air Pollution Control District and the Northern Sonoma County Air Pollution Control District, dated February 2, 1976, EPA is today amending 40 CFR 60.4, *Address*, to reflect this delegation. A Notice announcing this delegation is published today in the Notice section of this issue. The amended § 60.4 is set forth below. It adds the addresses of the Ventura County and Northern Sonoma County Air Pollution Control Districts, to which must be addressed all reports, requests, applications, submittals, and communications pursuant to this part by sources subject to the NSPS located within these Air Pollution Control Districts.

The Administrator finds good cause for foregoing prior public notice and for making this rulemaking effective immediately in that it is an administrative change and not one of substantive content. No additional substantive burdens are imposed on the parties affected. The delegation which is reflected by this administrative amendment was effective on Febraury 2, 1976, and it serves no purposes to delay the technical change of this addition of the Air Pollution Control District addresses to the Code of Federal Regulations.

This rulemaking is effective immediately.

(Sec. 111 of the Clean Air Act, as amended [42 U.S.C. 1857c-6]).

Dated: May 3, 1976.

STANLEY W. LEGRO,
Assistant Administrator for Enforcement.

Part 60 of Chapter I, Title 40 of the Code of Federal Regulations is amended as follows:

1. Section 60.4(b) is amended by revising subparagraph F to read as follows:

§ 60.4 Address.

* * * * *

(b) * * *

F California—

Bay Area Air Pollution Control District, 939 Ellis St., San Francisco, CA 94109.

Del Norte County Air Pollution Control District, Courthouse, Crescent City, CA 95531.

Humboldt County Air Pollution Control District, 5600 S. Broadway, Eureka, CA 95501.

Kern County Air Pollution Control District, 1700 Flower St. (P.O. Box 997), Bakersfield, CA 93302.

Monterey Bay Unified Air Pollution Control District, 420 Church St. (P.O. Box 487), Salinas, CA 93901.

Northern Sonoma County Air Pollution Control District, 3313 Chanate Rd., [illegible]ta Rosa, CA 95404.

Trinity County Air Pollution Control District, Box AJ, Weaverville, CA 96093

Ventura County Air Pollution Control District, 625 E. Santa Clara St., Ventura, CA 93001.

FEDERAL REGISTER, VOL. 41, NO. 103—WEDNESDAY, MAY 26, 1976

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Title 40—Protection of Environment

[FRL 563-8]

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

SUBCHAPTER C—AIR PROGRAMS

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Delegation of Authority to State of Utah

Pursuant to the delegation of authority for the standards of performance for twelve (12) categories of new stationary sources (NSPS) to the State of Utah on May 13, 1976, EPA is today amending 40 CFR 60.4, Address, to reflect this delegation. A Notice announcing this delegation is published today in the FEDERAL REGISTER. The amended § 60.4, which adds the address of the Utah Air Conservation Committee to which all reports, requests, applications, submittals, and communications to the Administrator pursuant to this part must also be addressed, is set forth below.

The Administrator finds good cause for foregoing prior public notice and for making this rulemaking effective immediately in that it is an administrative change and not one of substantive content. No additional substantive burdens are imposed on the parties affected. The delegation which is reflected by this administrative amendment was effective on May 13, 1976, and it serves no purpose to delay the technical change of this addition of the State address to the Code of Federal Regulations.

This rulemaking is effective immediately, and is issued under the authority of section 111 of the Clean Air Act, as amended, 42 U.S.C. 1857c-6.

Dated: June 10, 1976.

STANLEY W. LEGRO,
Assistant Administrator for Enforcement.

Part 60 of Chapter I, Title 40 of the Code of Federal Regulations is amended as follows:

1. In § 60.4 paragraph (b) is amended by revising subparagraph (TT) to read as follows:

§ 60.4 Address.

* * * * *

(b) * * *

(TT)—State of Utah, Utah Air Conservation Committee, State Division of Health, 44 Medical Drive, Salt Lake City, Utah 84113.

* * * * *

[FR Doc.76-17432 Filed 6-14-76;8:45 am]

FEDERAL REGISTER, VOL. 41, NO. 116—TUESDAY, JUNE 15, 1976

38 Title 40—Protection of Environment

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

SUBCHAPTER C—AIR PROGRAMS

[FRL 564–6]

NEW SOURCE REVIEW

Delegation of Authority to the State of Georgia

The amendments below institute certain address changes for reports and applications required from operators of new sources. EPA has delegated to the State of Georgia authority to review new and modified sources. The delegated authority includes the reviews under 40 CFR Part 52 for the prevention of significant deterioration. It also includes the review under 40 CFR Part 60 for the standards of performance for new stationary sources and review under 40 CFR Part 61 for national emission standards for hazardous air pollutants.

A notice announcing the delegation of authority is published elsewhere in the Notices section this issue of the FEDERAL REGISTER. These amendments provide that all reports, requests, applications, submittals, and communications previously required for the delegated reviews will now be sent instead to the Environmental Protection Division, Georgia Department of Natural Resources, 270 Washington Street SW., Atlanta, Georgia 30334, instead of EPA's Region IV.

The Regional Administrator finds good cause for foregoing prior public notice and for making this rulemaking effective immediately in that it is an administrative change and not one of substantive content. No additional substantive burdens are imposed on the parties affected. The delegation which is reflected by this administrative amendment was effective on May 3, 1976, and it serves no purpose to delay the technical change of this addition of the State address to the Code of Federal regulations.

This rulemaking is effective immediately, and is issued under the authority of Sections 101, 110, 111, 112 and 301 of the Clean Air Act, as amended 42 U.S.C. 1857, 1857C–5, 6, 7 and 1857g.

Dated: June 11, 1976.

JACK E. RAVAN,
Regional Administrator.

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

DELEGATION OF AUTHORITY TO THE STATE OF GEORGIA

Part 60 of Chapter I, Title 40, Code of Federal Regulations, is amended as follows:

2. In § 60.4, paragraph (b)(L) is revised to read as follows:

§ 60.4 Address.

* * * * *

(b) * * *

(L) State of Georgia, Environmental Protection Division, Department of Natural Resources, 270 Washington Street, S.W., Atlanta, Georgia 30334.

FEDERAL REGISTER, VOL. 41, NO. 120—
—MONDAY, JUNE 21, 1976

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SUBCHAPTER C—AIR PROGRAMS

[FRL 574–3]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Delegation of Authority to State of California on Behalf of Fresno, Mendocino, San Joaquin, and Sacramento County Air Pollution Control Districts

Pursuant to the delegation of authority for the standards of performance for new stationary sources (NSPS) to the State of California on behalf of the Fresno County Air Pollution Control District, the Mendocino County Air Pollution Control District, the San Joaquin County Air Pollution Control District, and the Sacramento County Air Pollution Control District, dated March 29, 1976, EPA is today amending 40 CFR 60.4, *Address*, to reflect this delegation. A Notice announcing this delegation is published today in the Notice Section of this issue. The amended § 60.4 is set forth below. It adds the addresses of the Fresno County, Mendocino County, San Joaquin County, and Sacramento County Air Pollution Control Districts, to which must be addressed all reports, requests, applications, submittals, and communications pursuant to this part by sources subject to the NSPS located within these Air Pollution Control Districts.

The Administrator finds good cause for foregoing prior public notice and for making this rulemaking effective immediately in that it is an administrative change and not one of substantive content. No additional substantive burdens are imposed on the parties affected. The delegation which is reflected by this administrative amendment was effective on March 29, 1976, and it serves no purpose to delay the technical change of this addition of the Air Pollution Control District addresses to the Code of Federal Regulations.

This rulemaking is effective immediately, and is issued under the authority of section 111 of the Clean Air Act, as amended [42 U.S.C. 1857c–6].

Dated: June 15, 1976.

STANLEY W. LEGRO,
Assistant Administrator for Enforcement.

Part 60 of Chapter I, Title 40, of the Code of Federal Regulations, is amended as follows:

1. In § 60.4, paragraph (b) is amended by revising subparagraph F to read as follows:

§ 60.4 Address.

* * * * *

(b) * * *

(A)–(E) * * *

(F) California:

Bay Area Air Pollution Control District, 939 Ellis St., San Francisco, CA 94109
Del Norte County Air Pollution Control District, Courthouse, Crescent City, CA 95531
Fresno County Air Pollution Control District, 515 S. Cedar Ave., Fresno, CA 93702
Humboldt County Air Pollution Control District, 5600 S. Broadway, Eureka, CA 95501
Kern County Air Pollution Control District, 1700 Flower St. (P.O. Box 997), Bakersfield, CA 93302
Mendocino County Air Pollution Control District, County Courthouse, Ukiah, CA 95482
Monterey Bay Unified Air Pollution Control District, 420 Church St. (P.O. Box 487), Salinas, CA 93901
Northern Sonoma County Air Pollution Control District, 3313 Chanate Rd., Santa Rosa, CA 95404
Sacramento County Air Pollution Control District, 2221 Stockton Blvd., Sacramento, CA 95827
San Joaquin County Air Pollution Control District, 1601 E. Hazelton St. (P.O. Box 2009), Stockton, CA 95201
Trinity County Air Pollution Control District, Box AJ, Weaverville, CA 96093
Ventura County Air Pollution Control District, 625 E. Santa Clara St., Ventura, CA 93001

FEDERAL REGISTER, VOL. 41, NO. 132—
—THURSDAY, JULY 8, 1976

40 **Title 40—Protection of Environment**

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

[FRL 597-1]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Delegation of Authority to State of California on Behalf of Madera County Air Pollution Control District

Pursuant to the delegation of authority for the standards of performance for new stationary sources (NSPS) to the State of California on behalf of the Madera County Air Pollution Control District, dated May 12, 1976, EPA is today amending 40 CFR 60.4 *Address*, to reflect this delegation. A Notice announcing this delegation is published in the Notices Section of this issue of the FEDERAL REGISTER, Environmental Protection Agency, FRL 596-8. The amended § 60.4 is set forth below. It adds the address of the Madera County Air Pollution Control District, to which must be addressed all reports, requests, applications, submittals, and communications pursuant to this part by sources subject to the NSPS located within this Air Pollution Control District.

The Administrator finds good cause for foregoing prior public notice and for making this rulemaking effective immediately in that it is an administrative change and not one of substantive content. No additional substantive burdens are imposed on the parties affected. The delegation which is reflected by this administrative amendment was effective on May 12, 1976, and it serves no purpose to delay the technical change of this addition of the Air Pollution Control District address to the Code of Federal Regulations.

This rulemaking is effective immediately, and is issued under the authority of Section 111 of the Clean Air Act, as amended [42 U.S.C. 1857c-6].

Dated: July 27, 1976.

PAUL DEFALCO,
Regional Administrator,
Region IX, EPA.

Part 60 of Chapter I, Title 40 of the Code of Federal Regulations is amended as follows:

1. In § 60.4 paragraph (b) is amended by revising subparagraph F to read as follows:

§ 60.4 Address.

* * * * *

(b) * * *

F—CALIFORNIA

Bay Area Air Pollution Control District, 939 Ellis St., San Francisco, CA 94109
Del Norte County Air Pollution Control District, Courthouse, Crescent City, CA 95531
Fresno County Air Pollution Control District, 515 S. Cedar Avenue, Fresno, CA 93702
Humboldt County Air Pollution Control District, 5600 S. Broadway, Eureka, CA 95501
Kern County Air Pollution Control District, 1700 Flower St. (P.O. Box 997), Bakersfield, CA 93302
Madera County Air Pollution Control District, 135 W. Yosemite Avenue, Madera, CA 93637
Mendocino County Air Pollution Control District, County Courthouse, Ukiah, CA 95482
Monterey Bay Unified Air Pollution Control District, 420 Church St. (P.O. Box 487), Salinas, CA 93901
Northern Sonoma County Air Pollution Control District, 3313 Chanate Rd., Santa Rosa, CA 95404
Sacramento County Air Pollution Control District, 3221 Stockton Blvd., Sacramento, CA 95827
San Joaquin County Air Pollution Control District, 1601 E. Hazelton St. (P.O. Box 2009), Stockton, CA 95201
Trinity County Air Pollution Control District, Box AJ, Weaverville, CA 96093
Ventura County Air Pollution Control District, 625 E. Santa Clara St., Ventura, CA 93001

* * * * *

[FR Doc.76-23146 Filed 8-6-76;8:45 am]

FEDERAL REGISTER, VOL. 41, NO. 154

MONDAY, AUGUST 9, 1976

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41 **Title 40—Protection of Environment**

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

SUBCHAPTER C—AIR PROGRAMS

[FRL 600-4]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCE

Delegation of Authority to the U.S. Virgin Islands

Pursuant to the delegation of authority for the standards of performance for new stationary sources (NSPS) to the U.S. Virgin Islands on June 30, 1976, EPA is today amending 40 CFR 60.4, Address, to reflect this delegation. A Notice announcing this delegation is published at page 34685 of today's FEDERAL REGISTER. The amended § 60.4, which adds the address of the U.S. Virgin Islands, Department of Conservation and Cultural Affairs, to which reports, requests, applications, submittals, and communications to the Administrator pursuant to this part must also be addressed, is set forth below.

The Administrator finds good cause for foregoing prior public notice and for making this rulemaking effective immediately in that it is an administrative change and not one of substantive content. No additional substantive burdens are imposed on the parties affected. The delegation which is reflected by this administrative amendment was effective on June 30, 1976, and it serves no purpose to delay the technical change of this addition of the U.S. Virgin Islands address to the Code of Federal Regulations.

This rulemaking is effective immediately, and is issued under the authority of Section 111 of the Clean Air Act, as amended.

(42 U.S.C. 1857c-6)

Dated: August 4, 1976.

GERALD M. HANSLER,
Regional Administrator,
Region II.

1. In § 60.4 paragraph (b) is amended by revising subparagraph (CCC) to read as follows:

§ 60.4 Address.

* * * * *

(b) * * *

(BBB) * * *

(CCC)—U.S. Virgin Islands: U.S. Virgin Islands Department of Conservation and Cultural Affairs, P.O. Box 578, Charlotte Amalie, St. Thomas, U.S. Virgin Islands 00801.

[FR Doc.76-23896 Filed 8-13-76;8:45 am]

FEDERAL REGISTER, VOL. 41, NO. 159

MONDAY, AUGUST 16, 1976

42 [FRL 598-2]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Revision to Emission Monitoring Requirements

On October 6, 1975 (40 FR 46250), under section 111 of the Clean Air Act, as amended, the Environmental Protection Agency (EPA) promulgated emission monitoring requirements and revisions to the performance testing methods in 40 CFR Part 60. The provisions of § 60.13(i) allow the Administrator to approve alternatives to monitoring procedures or requirements only upon written application by an owner or operator of an affected facility; monitoring equipment manufacturers would not be allowed to apply for approval of alternative monitoring equipment. Since EPA did not intend to prevent monitoring equipment manufacturers from applying for approval of alternative monitoring equipment, § 60.13(i) is being revised. As revised, any person will be allowed to make application to the Administrator for approval of alternative monitoring procedures or requirements.

This revision does not add new requirements, rather it provides greater flexibility for approval of alternative equipment and procedures. This revision is effective (date of publication).

(Sections 111, 114, and 301(a) of the Clean Air Act, as amended by sec. 4(a) of Pub. L. 91-604, 84 Stat. 1678 and by sec. 15(c)(2) of Pub. L. 91-604, 84 Stat. 1713 (42 U.S.C. 1857c-6, 1857c-9, and 1857g(a)).)

Dated: August 15, 1976.

RUSSELL E. TRAIN,
Administrator.

In 40 CFR Part 60, Subpart A is amended as follows:

1. Section 60.13 is amended by revising paragraph (i) as follows:

§ 60.13 Monitoring requirements.

* * * * *

(i) After receipt and consideration of written application, the Administrator may approve alternatives to any monitoring procedures or requirements of this part including, but not limited to the following:

* * * * *

[FR Doc.76-24505 Filed 8-19-76;8:45 am]

FEDERAL REGISTER, VOL. 41, NO. 163

FRIDAY, AUGUST 20, 1976

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PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

5. By revising § 60.9 to read as follows:

§ 60.9 Availability of information.

The availability to the public of information provided to, or otherwise obtained by, the Administrator under this Part shall be governed by Part 2 of this chapter. (Information submitted voluntarily to the Administrator for the purposes of §§ 60.5 and 60.6 is governed by § 2.201 through § 2.213 of this chapter and not by § 2.301 of this chapter.)

FEDERAL REGISTER, VOL. 41, NO. 171

WEDNESDAY, SEPTEMBER 1, 1976

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44 Title 40—Protection of Environment

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

SUBCHAPTER C—AIR PROGRAMS

[FRL 617-2]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Delegation of Authority to State of California on Behalf of Stanislaus County Air Pollution Control District; Delegation of Authority to State of California on Behalf of Sacramento County Air Pollution Control District; Correction

Pursuant to the delegation of authority for the standards of performance for new stationary sources (NSPS) to the State of California on behalf of the Stanislaus County Air Pollution Control District, dated July 2, 1976, EPA is today amending 40 CFR 60.4 *Address*, to reflect this delegation. A notice announcing this delegation is published today at 41 FR 40108. The amended § 60.4 is set forth below. It adds the address of the Stanislaus County Air Pollution Control District, to which must be addressed all reports, requests, applications, submittals, and communications pursuant to this part by sources subject to the NSPS located within this Air Pollution Control District.

On July 8, 1976, EPA amended 40 CFR 60.4, *Address* to reflect delegation of authority for NSPS to the State of California on behalf of the Sacramento County Air Pollution Control District. By letter of July 30, 1976, Colin T. Greenlaw, M.D., Sacramento County Air Pollution Control Officer, notified EPA that the address published at 41 FR 27967 was incorrect. Therefore, EPA is today also amending 40 CFR 60.4, *Address* to reflect the correct address for the Sacramento County Air Pollution Control District.

The Administrator finds good cause for foregoing prior public notice and for making this rulemaking effective immediately in that it is an administrative change and not one of substantive content. No additional substantive burdens are imposed on the parties affected. The delegations which are reflected by this administrative amendment were effective on July 2, 1976 and March 29, 1976, and it serves no purpose to delay the technical change of these additions of the Air Pollution Control Districts addresses to the Code of Federal Regulations.

This rulemaking is effective immediately, and is issued under the authority of Section 111 of the Clean Air Act, as amended (42 U.S.C. 1857c-6)

Dated: September 8, 1976.

L. RUSSELL FREEMAN,
Acting Regional Administrator,
Region IX, EPA.

Part 60 of Chapter I, Title 40 of the Code of Federal Regulations is amended as follows:

1. In § 60.4 paragraph (b)(f) is revised to read as follows:

§ 60.4 Address.

* * * * *

(b) * * *

(F) California;

Bay Area Air Pollution Control District, 939 Ellis St., San Francisco, CA 94109
Del Norte County Air Pollution Control District, Courthouse, Crescent City, CA 95531
Fresno County Air Pollution Control District, 515 S. Cedar Avenue, Fresno, CA 93702
Humboldt County Air Pollution Control District, 5600 S. Broadway, Eureka, CA 95501
Kern County Air Pollution Control District, 1700 Flower St. (P.O. Box 997), Bakersfield, CA 93302
Madera County Air Pollution Control District, 135 W. Yosemite Avenue, Madera, CA 93637
Mendocino County Air Pollution Control District, County Courthouse, Ukiah, CA 95482
Monterey Bay Unified Air Pollution Control District, 420 Church St. (P.O. Box 487), Salinas, CA 93901
Northern Sonoma County Air Pollution Control District, 3313 Chanate Rd., Santa Rosa, CA 95404
Sacramento County Air Pollution Control District, 3701 Branch Center Road, Sacramento, CA 95827
San Joaquin County Air Pollution Control District, 1601 E. Hazelton St. (P.O. Box 2009), Stockton, CA 95201
Stanislaus County Air Pollution Control District, 820 Scenic Drive, Modesto, CA 95350
Trinity County Air Pollution Control District, Box AJ, Weaverville, CA 96093
Ventura County Air Pollution Control District, 625 E. Santa Clara St., Ventura, CA 93001

* * * * *

[FR Doc.76-27175 Filed 9-16-76;8:45 am]

FEDERAL REGISTER, VOL. 41, NO. 182

FRIDAY, SEPTEMBER 17, 1976

45 **Title 40—Protection of Environment**

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

[FRL 619-1]

SUBCHAPTER C—AIR PROGRAMS

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

PART 61—NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS

Reports and Applications From Operators of New Sources; Address Changes

DELEGATION OF AUTHORITY TO THE STATE OF ALABAMA

The amendments below institute certain address changes for reports and applications required from operators of new sources. EPA has delegated to the State of Alabama authority to review new and modified sources. The delegated authority includes the review under 40 CFR Part 60 for the standards of performance for new stationary sources and review under 40 CFR Part 61 for national emission standards for hazardous air pollutants.

A notice announcing the delegation of authority is published elsewhere in this issue of the FEDERAL REGISTER. These amendments provide that all reports, requests, applications, submittals, and communications previously reuired for the delegated reviews will now be sent instead to the Air Pollution Control Division, Alabama Air Pollution Control Commission, 645 South McDonough Street, Montgomery, Alabama 36104, instead of EPA's Region IV.

The Regional Administrator finds good cause for foregoing prior public notice and for making this rulemaking effective immediately in that it is an administrative change and not one of substantive content. No additional substantive burdens are imposed on the parties affected. The delegation which is reflected by this administrative amendment was effective on August 5, 1976, and it serves no purpose to delay the technical change of this addition of the State address to the Code of Federal Regulations.

This rulemaking is effective immediately, and is issued under the authority of sections 111, 112, and 301 of the Clean Air Act, as amended 42 U.S.C. 1857, 1857c–5, 6, 7 and 1857g.

Dated: September 9, 1976.

JACK E. LAVAN,
Regional Administrator.

Part 60 of Chapter I, Title 40, Code of Federal Regulations, is amended as follows:

1. In § 60.4, paragraph (b) is amended by revising subparagraph (B) to read as follows:

§ 60.4 Address.

* * * * *

(b) * * *

(B) State of Alabama, Air Pollution Control Division, Air Pollution Control Commission, 645 S. McDonough Street, Montgomery, Alabama 36104.

FEDERAL REGISTER, VOL. 41, NO. 183
MONDAY, SEPTEMBER 20, 1976

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46 **Title 40—Protection of Environment**

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

SUBCHAPTER C—AIR PROGRAMS

[FRL 623-7]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Delegation of Authority to the State of Indiana

Pursuant to the delegation of authority to implement the standards of performance for new stationary sources (NSPS) to the State of Indiana on April 21, 1976, **EPA is today amending 40 CFR 60.4, *Address*, to reflect this delegation.** A notice announcing this delegation is published Thursday, September 30, 1976 (41 FR 43237). The amended § 60.4, which adds the address of the Indiana Air Pollution Control Board to that list of addresses to which all reports, requests, applications, submittals, and communications to the Administrator pursuant to this part must be sent, is set forth below.

The Administrator finds good cause for foregoing prior notice and for making this rulemaking effective immediately in that it is an administrative change and not one of substantive content. No additional substantive burdens are imposed on the parties affected. The delegation which is reflected by this administrative amendment was effective on April 21, 1976, and it serves no purpose to delay the technical change of this addition of the State address to the Code of Federal Regulations.

This rulemaking is effective immediately.

(Sec. 111 of the Clean Air Act, as amended, 42 U.S.C. 1857c–6.)

Dated: September 22, 1976.

GEORGE R. ALEXANDER, Jr.,
Regional Administrator.

Part 60 of Chapter I, Title 40 of the Code of Federal Regulations is amended as follows:

1. In § 60.4, paragraph (b) is amended by revising subparagraph P, to read as follows:

§ 60.4 Address.

* * * * *

(b) * * *

(A)–(O) * * *

(P) State of Indiana, Indiana Air Pollution Control Board, 1330 West Michigan Street, Indianapolis, Indiana 46206.

* * * * *

[FR Doc.76-28507 Filed 9-29-76;8:45 am]

FEDERAL REGISTER, VOL. 41, NO. 191
THURSDAY, SEPTEMBER 30, 1976

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47 **Title 40—Protection of Environment**

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

SUBCHAPTER C—AIR PROGRAMS

[FRL 629-8]

PART 60—STANDARDS OF PERFORMANCE FOR STATIONARY SOURCES

PART 61—NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS

Delegation of Authority to State of North Dakota

Pursuant to the delegation of authority for the standards of performance for new sources (NSPS) and national emission standards for hazardous air pollutants (NESHAPS) to the State of North Dakota on August 30, 1976, EPA is today amending respectively 40 CFR 60.4 and 61.04 Address, to reflect this delegation. A notice announcing this delegation is published today in the notices section. The amended §§ 60.4 and 61.04 which add the address of the North Dakota State Department of Health to which all reports, requests, applications, submittals, and communications to the Administrator pursuant to these parts must also be addressed, are set forth below.

The Administrator finds good cause for foregoing prior public notice and for making this rulemaking effective immediately in that it is an administrative change and not one of substantive content. No additional substantive burdens are imposed on the parties affected. The delegation which is reflected by this administrative amendment was effective on August 30, 1976, and it serves no purpose to delay the technical change of this addition to the State address to the Code of Federal Regulations.

This rulemaking is effective immediately, and is issued under the authority of sections 111 and 112 of the Clean Air Act, as amended. (42 U.S.C. 1857c–6 and –7).

Dated: October 1, 1976.

JOHN A. GREEN,
Regional Administrator.

Parts 60 and 61 of Chapter I, Title 40 of the Code of Federal Regulations are respectively amended as follows:

1. In § 60.4, paragraph (b) is amended by revising subparagraph (JJ) to read as follows:

§ 60.4 Address.

* * * * *

(b) * * *

(A)–(Z) * * *
(AA)–(II) * * *
(JJ)—State of North Dakota, State Department of Health, State Capitol, Bismarck, North Dakota 58501.

FEDERAL REGISTER, VOL. 41, NO. 199
WEDNESDAY, OCTOBER 13, 1976

48

Title 40—Protection of Environment

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

SUBCHAPTER C—AIR PROGRAMS

[FRL 638-4]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Delegation of Authority to State of California On Behalf of Santa Barbara County Air Pollution Control District

Pursuant to the delegation of authority for the standards of performance for new stationary sources (NSPS) to the State of California on behalf of the Santa Barbara County Air Pollution Control District, dated September 17, 1976, EPA is today amending 40 CFR 60.4 Address, to reflect this delegation. A Notice announcing this delegation is published in the Notices section of this issue of the FEDERAL REGISTER. The amended § 60.4 is set forth below. It adds the address of the Santa Barbara County Air Pollution Control District, to which must be addressed all reports, requests; applications, submittals, and communications pursuant to this part by sources subject to the NSPS located within this Air Pollution Control District.

The Administrator finds good cause for foregoing prior public notice and for making this rulemaking effective immediately in that it is an administrative change and not one of substantive content. No additional substantive burdens are imposed on the parties affected. The delegation which is reflected this administrative amendment was effective on September 17, 1976 and it serves no purpose to delay the technical change on this addition of the Air Pollution Control District's address to the Code of Federal Regulations.

This rulemaking is effective immediately, and is issued under the authority of section 111 of the Clean Air Act, as amended (42 U.S.C. 1857c-6).

Dated: October 20, 1976.

PAUL DE FALCO, JR.,
Regional Administrator,
EPA, Region IX.

Part 60 of Chapter I, Title 40 of the Code of Federal Regulations is amended as follows:

1. In § 60.4 paragraph (b)(3) is amended by revising subparagraph F to read as follows:

§ 60.4 Address.

* * * * *

(b) * * *
(3) * * *

(A)-(E) * * *

F—CALIFORNIA

Bay Area Air Pollution Control District, 939 Ellis St., San Francisco, CA 94109.

Del Norte County Air Pollution Control District, Courthouse, Crescent City, CA 95531.

Fresno County Air Pollution Control District, 515 S. Cedar Avenue, Fresno, CA 93702.

Humboldt County Air Pollution Control District, 5600 S. Broadway, Eureka, CA 95501.

Kern County Air Pollution Control District, 1700 Flower St. (P.O. Box 997), Bakersfield, CA 93302.

Madera County Air Pollution Control District, 135 W. Yosemite Avenue, Madera, CA 93637.

Mendocino County Air Pollution Control District, County Courthouse, Ukiah, CA 95482.

Monterey Bay Unified Air Pollution Control District, 420 Church St. (P.O. Box 487), Salinas, CA 93901.

Northern Sonoma County Air Pollution Control District, 3313 Chanate Rd., Santa Rosa, CA 95404.

Sacramento County Air Pollution Control District, 3701 Branch Center Road, Sacramento, CA 95827.

San Joaquin County Air Pollution Control District, 1601 E. Hazelton St. (P.O. Box 2009), Stockton, CA 95201.

Santa Barbara County Air Pollution Control District, 4440 Calle Real, Santa Barbara, CA 93110.

Stanislaus County Air Pollution Control District, 820 Scenic Drive, Modesto, CA 95350.

Trinity County Air Pollution Control District, Box AJ, Weaverville, CA 96093.

Ventura County Air Pollution Control District, 625 E. Santa Clara St., Ventura, CA 93001.

* * * * *

[FR Doc.76-32104 Filed 11-2-76;8:45 am]

FEDERAL REGISTER, VOL. 41, NO. 213
WEDNESDAY, NOVEMBER 3, 1976

49

Title 40—Protection of Environment

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

SUBCHAPTER C—AIR PROGRAMS

[FRL 639-3]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Amendments to Subpart D

Standards of performance for fossil fuel-fired steam generators of more than 73 megawatts (250 million Btu per hour) heat input rate are provided under Subpart D of 40 CFR Part 60. Subpart D is amended herein to revise the application of the standards of performance for facilities burning wood residues in combination with fossil fuel.

Subpart D contains standards for particulate matter, sulfur dioxide, nitrogen oxides, and visible emissions from steam generators. These standards, except for the one applicable to visible emissions, are based on heat input. For sulfur dioxide, there are separate standards for liquid fossil fuel-fired and solid fossil fuel-fired facilities with provisions for a prorated standard when combinations of different fossil fuels are fired. There is no sulfur dioxide standard for gaseous fossil fuel-fired facilities since they emit negligible amounts of sulfur dioxide.

To date, there have been two ways for a source owner or operator to comply with the sulfur dioxide standard: (1) By firing low sulfur fossil fuels or (2) by using flue gas desulfurization systems. Complying with the standard by firing low sulfur fossil fuel requires an adequate supply of fuel with a sulfur content low enough to meet the standard. However, it would be possible for the owner or operator to fire, for example, a relatively high sulfur fossil fuel with a very low sulfur fossil fuel (e.g. natural gas) to obtain a fuel mixture which would meet the standard. The low sulfur fuel adds to the heat input but not to the sulfur dioxide emissions and, thereby, has an overall fuel sulfur reduction effect. In the past, the application of Subpart D permitted the heat content of fossil fuels but not wood residue to be used in determining compliance with the standards for particulate matter, sulfur dioxide and nitrogen oxides; the amendment made herein will allow the heat content of wood residue to be used for determining compliance with the standards. The amendment does not change the scope of applicability of Subpart D; all steam generating units constructed after August 17, 1971, and capable of firing fossil fuel at a heat input rate of more than 73 megawatts (250 million Btu per hour) are subject to Subpart D.

RATIONALE FOR THE AMENDMENTS

Wood residue, which includes bark, sawdust, chips, etc., is not a fossil fuel and thus has not been allowed for use as a dilution agent in complying with the sulfur dioxide standard for steam generators. Several companies have requested that EPA revise Subpart D to permit blending of wood residue with high sulfur fossil fuels. This would enable them to obtain a fuel mixture low enough in sulfur to comply with the sulfur dioxide standard. Since Subpart D allows the blending of high and low sulfur fossil fuels, EPA has concluded that it is reasonable to extend application of this principle to wood residue which, although not a fossil fuel, does have low sulfur content.

Several companies have expressed interest in constructing steam generators which continuously fire wood residue in combination with fossil fuel. New facilities will comply with the standards for less cost than at present because they will be able to use wood residue, a valuable source of energy, as an alternative to expense low sulfur fossil fuels. Also, using wood residue as a fuel supplement instead of low sulfur fossil fuels will result in substantial savings in the consumption of scarce natural gas and oil resources, and will relieve what would otherwise be a substantial solid waste disposal problem. Consumption of energy and raw material resources will be reduced further by minimizing the need for flue gas desulfurization systems at new facilities. There will be no adverse environmental impact; neither sulfur dioxide nor nitrogen oxides emissions will increase as a result of this action. Considering the beneficial, environmental, energy, and economic impacts, it is reasonable to permit wood residue to be fired as a low sulfur fuel to aid in compliance with the standards for fossil fuel-fired steam generators.

In making this amendment, EPA recognizes that affected facilities which burn substantially more wood residue than fossil fuel may have difficulty complying with the 43 nanogram per joule standard for particulate matter (0.1 pound per million Btu). There is not sufficient information available at this time to determine what level of particulate matter emissions is achievable; however, EPA is continuing to gather information on this question. If EPA determines that the particulate matter standard is not achievable, appropriate changes will be made to the standard. Any change would be proposed for public comment; however, in the interim, owners and operators will be subject to the 43 nanogram per joule standard.

'F' FACTOR DETERMINATION

New facilities firing wood residue in combination with fossil fuel will be subject to the emission and fuel monitoring requirements of § 60.45 (as revised on October 6, 1975, 40 FR 46250). The 'F' factors listed in § 60.45(f)(4), which are used for converting continuous monitoring data and performance test data into units of the standard, presently apply only to fossil fuels. Therefore, 'F' factors for bark and wood residue have been added to § 60.45(f)(4). Any owner or operator who elects to calculate his own 'F' factor must obtain approval of the Administrator.

INTERNATIONAL SYSTEM OF UNITS

In accordance with the objective to implement national use of the metric system, EPA presents numerical values in both metric units and English units in its regulations and technical publications. In an effort to simplify use of the metric units of measurements, EPA now uses the International System of Units (SI) as set forth in a publication by the American Society for Testing and Materials entitled "Standard for Metric Practice" (Designation: E 380–76). The following amendments to Subpart D reflect the use of SI units.

MISCELLANEOUS

Since these amendments are expected to have limited applicability, no environmental impact statement is required for this rulemaking pursuant to section 1(b) of the "Procedures for the Voluntary Preparation of Environmental Impact Statements" (39 FR 37419).

This action is effective on November 22, 1976. The Agency finds that good cause exists for not publishing this action as a notice of proposed rulemaking and for making it effective immediately upon publication because:

1. The action is expected to have limited applicability.
2. The action will remove an existing restriction on operations without increasing emissions and will have beneficial environmental, energy, and economic effects.
3. The action is not technically controversial and does not alter the overall substantive content of Subpart D.
4. Immediate effectiveness of the action will enable affected parties to proceed promptly and with certainty in conducting their affairs.

(Secs. 111, 114 and 301(a) of the Clean Air Act, as amended by section 4(a) of Pub.L. 91–604, 84 Stat. 1678, and by section 15(c)(2) of Pub.L. 91–604, 84 Stat. 1713 (42 U.S.C. 1857c–6, 1857c–9, 1857g(a)).)

Date: November 15, 1976.

JOHN QUARLES,
Acting Administrator.

Part 60 of Chapter I, Title 40 of the Code of Federal Regulations is amended as follows:

1. Section 60.40 is amended by revising the designation of affected facility and by substituting the International System (SI) of Units as follows:

§ 60.40 Applicability and designation of affected facility.

(a) The affected facilities to which the provisions of this subpart apply are:

(1) Each fossil fuel-fired steam generating unit of more than 73 megawatts heat input rate (250 million Btu per hour).

(2) Each fossil fuel and wood residue-fired steam generating unit capable of firing fossil fuel at a heat input rate of more than 73 megawatts (250 million Btu per hour).

(b) Any change to an existing fossil fuel-fired steam generating unit to accommodate the use of combustible materials, other than fossil fuels as defined in this subpart, shall not bring that unit under the applicability of this subpart.

2. Section 60.41 is amended by adding paragraphs (d) and (e) as follows:

§ 60.41 Definitions.

* * * * *

(d) "Fossil fuel and wood residue-fired steam generating unit" means a furnace or boiler used in the process of burning fossil fuel and wood residue for the purpose of producing steam by heat transfer.

(e) "Wood residue" means bark, sawdust, slabs, chips, shavings, mill trim, and other wood products derived from wood processing and forest management operations.

3. Section 60.42 is amended by revising paragraph (a)(1) and by substituting SI units in paragraph (a)(1) as follows:

§ 60.42 Standard for particulate matter.

(a) * * *

(1) Contain particulate matter in excess of 43 nanograms per joule heat input (0.10 lb per million Btu) derived from fossil fuel or fossil fuel and wood residue.

* * * * *

4. Section 60.43 is amended by revising paragraphs (a)(1) and (a)(2), by substituting SI units in paragraphs (a)(1) and (a)(2), and by revising the formula in paragraph (b) as follows:

§ 60.43 Standard for sulfur dioxide.

(a) * * *

(1) 340 nanograms per joule heat input (0.80 lb per million Btu) derived from liquid fossil fuel or liquid fossil fuel and wood residue.

(2) 520 nanograms per joule heat input (1.2 lb per million Btu) derived from solid fossil fuel or solid fossil fuel and wood residue.

(b) When different fossil fuels are burned simultaneously in any combination, the applicable standard (in ng/J) shall be determined by proration using the following formula:

$$PS_{SO_2} = \frac{y(340) + z(520)}{y + z}$$

where:

PS_{SO_2} is the prorated standard for sulfur dioxide when burning different fuels simultaneously, in nanograms per joule heat input derived from all fossil fuels fired or from all fossil fuels and wood residue fired,
y is the percentage of total heat input derived from liquid fossil fuel, and
z is the percentage of total heat input derived from solid fossil fuel.

* * * * *

5. Section 60.44 is amended by revising paragraphs (a)(1), (a)(2), and (a)(3); by substituting SI units in paragraphs (a)(1), (a)(2), and (a)(3); and by revising paragraph (b) as follows:

§ 60.44 Standard for nitrogen oxides.

(a) * * *

(1) 86 nanograms per joule heat input (0.20 lb per million Btu) derived from gaseous fossil fuel or gaseous fossil fuel and wood residue.

(2) 130 nanograms per joule heat input (0.30 lb per million Btu) derived from liquid fossil fuel or liquid fossil fuel and wood residue.

(3) 300 nanograms per joule heat input (0.70 lb per million Btu) derived from solid fossil fuel or solid fossil fuel and wood residue (except lignite or a solid fossil fuel containing 25 percent, by weight, or more of coal refuse).

(b) When different fossil fuels are burned simultaneously in any combination, the applicable standards (in ng/J) shall be determined by proration. Compliance shall be determined by using the following formula:

$$PS_{NO_x}=\frac{x(86)+y(130)+z(300)}{x+y+z}$$

where:

PS_{NO_x} is the prorated standard for nitrogen oxides when burning different fuels simultaneously, in nanograms per joule heat input derived from all fossil fuels fired or from all fossil fuels and wood residue fired,

x is the percentage of total heat input derived from gaseous fossil fuel,

y is the percentage of total heat input derived from liquid fossil fuel, and

z is the percentage of total heat input derived from solid fossil fuel (except lignite or a solid fossil fuel containing 25 percent, by weight, or more of coal refuse).

When lignite or a solid fossil fuel containing 25 percent, by weight, or more of coal refuse is burned in combination with gaseous, liquid, other solid fossil fuel, or wood residue, the standard for nitrogen oxides does not apply.

6. Section 60.45 is amended by substituting SI units in paragraphs (e), (f)(1), (f)(2), (f)(4)(i), (f)(4)(ii), (f)(4)(iii), (f)(4)(iv), (f)(5), and (f)(5)(ii), by adding paragraphs (f)(4)(v) and (f)(5)(iii), and by revising paragraph (f)(6) as follows:

§ 60.45 Emission and fuel monitoring.

* * * * *

(e) An owner or operator required to install continuous monitoring systems under paragraphs (b) and (c) of this section shall for each pollutant monitored use the applicable conversion procedure for the purpose of converting continuous monitoring data into units of the applicable standards (nanograms per joule, pounds per million Btu) as follows:

* * * * *

(f) * * *

(1) E=pollutant emissions, ng/J (lb/million Btu).

(2) C=pollutant concentration, ng/dscm (lb/dscf), determined by multiplying the average concentration (ppm) for each one-hour period by 4.15×10^{4} M ng/dscm per ppm (2.59×10^{-9} M lb/dscf per ppm) where M=pollutant molecular weight, g/g-mole (lb/lb-mole). M=64.07 for sulfur dioxide and 46.01 for nitrogen oxides.

* * * * *

(4) * * *

(i) For anthracite coal as classified according to A.S.T.M. D 388–66, $F=2.723\times10^{-7}$ dscm/J (10,140 dscf/million Btu) and $F_c=0.532\times10^{-7}$ scm CO_2/J (1,980 scf CO_2/million Btu).

(ii) For subbituminous and bituminous coal as classified according to A.S.T.M. D 388–66, $F=2.637\times10^{-7}$ dscm/J (9,820 dscf/million Btu) and $F_c=0.486\times10^{-7}$ scm CO_2/J (1,810 scf CO_2/million Btu).

(iii) For liquid fossil fuels including crude, residual, and distillate oils, $F=2.476\times10^{-7}$ dscm/J (9,220 dscf/million Btu) and $F_c=0.384$ scm CO_2/J (1,430 scf CO_2/million Btu).

(iv) For gaseous fossil fuels, $F=2.347\times10^{-7}$ dscm/J 8,740 dscf/million Btu). For natural gas, propane, and butane fuels, $F_c=0.279\times10^{-7}$ scm CO_2/J (1,040 scf CO_2/million Btu) for natural gas, 0.322×10^{-7} scm CO_2/J (1,200 scf CO_2/million Btu) for propane, and 0.338×10^{-7} scm CO_2/J (1,260 scf CO_2/million Btu) for butane.

(v) For bark $F=1.076$ dscm/J (9,575 dscf/million Btu) and $F_c=0.217$ dscm/J (1,927 dscf/million Btu). For wood residue other than bark $F=1.038$ dscm/J (9,233 dscf/million Btu) and $F_c=0.207$ dscm/J (1,842 dscf/million Btu).

(5) The owner or operator may use the following equation to determine an F factor (dscm/J or dscf/million Btu) on a dry basis (if it is desired to calculate F on a wet basis, consult the Administrator) or F_c factor (scm CO_2/J, or scf CO_2/million Btu) on either basis in lieu of the F or F_c factors specified in paragraph (f)(4) of this section:

$$F=\frac{227.0(\%H)+95.7(\%C)+35.4(\%S)+8.6(\%N)-28.5(\%O)}{GCV}$$

(SI units)

$$F=\frac{10^{6}[3.64(\%H)+1.53(\%C)+0.57(\%S)+0.14(\%N)--0.46(\%O)]}{GCV}$$

(English units)

$$F_c=\frac{20.0(\%C)}{GCV}$$

(SI units)

$$F_c=\frac{321\times10^{3}(\%C)}{GCV}$$

(English units)

(i) * * *

(ii) GCV is the gross calorific value (kJ/kg, Btu/lb) of the fuel combusted, determined by the A.S.T.M. test methods D 2015–66(72) for solid fuels and D 1826–64(70) for gaseous fuels as applicable.

(iii) For affected facilities which fire both fossil fuels and nonfossil fuels, the F or F_c value shall be subject to the Administrator's approval.

(6) For affected facilities firing combinations of fossil fuels or fossil fuels and wood residue, the F or F_c factors determined by paragraphs (f)(4) or (f)(5) of this section shall be prorated in accordance with the applicable formula as follows:

$$F=\sum_{i=1}^{n} X_i F_i \text{ or } F_c=\sum_{i=1}^{n} X_i (F_c)_i$$

where:

X_i=the fraction of total heat input derived from each type of fuel (e.g. natural gas, bituminous coal, wood residue, etc.)

F_i or $(F_c)_i$=the applicable F or F_c factor for each fuel type determined in accordance with paragraphs (f)(4) and (f)(5) of this section.

n=the number of fuels being burned in combination.

* * * * *

7. Section 60.46 is amended by substituting SI units in paragraphs (b) and (f) and paragraph (g) is revised as follows:

§ 60.46 Test methods and procedures.

* * * * *

(b) For Method 5, Method 1 shall be used to select the sampling site and the number of traverse sampling points. The sampling time for each run shall be at least 60 minutes and the minimum sampling volume shall be 0.85 dscm (30 dscf) except that smaller sampling times or volumes, when necessitated by process variables or other factors, may be approved by the Administrator. The probe and filter holder heating systems in the sampling train shall be set to provide a gas temperature no greater than 433 K (320°F).

* * * * *

(f) For each run using the methods specified by paragraphs (a)(3), (a)(4), and (a)(5) of this section, the emissions expressed in ng/J (lb/million Btu) shall be determined by the following procedure:

$$E=CF\frac{20.9}{20.9-\text{percent } O_2}$$

where:

(1) E=pollutant emission ng/J (lb/million Btu).

(2) C=pollutant concentration, ng/dscm (lb/ dscf), determined by method 5, 6, or 7.

(3) Percent O_2=oxygen content by volume (expressed as percent), dry basis. Percent oxygen shall be determined by using the integrated or grab sampling and analysis procedures of Method 3 as applicable.

The sample shall be obtained as follows:

* * * * *

(g) When combinations of fossil fuels or fossil fuel and wood residue are fired, the heat input, expressed in watts (Btu/hr), is determined during each testing period by multiplying the gross calorific value of each fuel fired (in J/kg or Btu/lb) by the rate of each fuel burned (in kg/sec or lb/hr). Gross calorific values are determined in accordance with A.S.T.M. methods D 2015–66(72) (solid fuels), D 240–64(73) (liquid fuels), or D. 1826–64(7) (gaseous fuels) as applicable. The method used to determine calorific value of wood residue must be approved by the Administrator. The owner or operator shall determine the rate of fuels burned during each testing period by suitable methods and shall confirm the rate by a material balance over the steam generation system.

(Sections 111, 114, and 301(a) of the Clean Air Act as amended by section 4(a) of Pub. L. 91-604, 84 Stat. 1678 and by section 15(c)(2) of Pub. L. 91-604, 84 Stat. 1713 (42 U.S.C. 1857c-6, 1857c-9, 1857g(a)).

[FR Doc.76-33966 Filed 11-19-76;8:45 am]

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50 Title 40—Protection of Environment

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

[FRL 639-2]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Amendments to Reference Methods 13A and 13B

On August 6, 1975 (40 FR 33151), the Environmental Protection Agency (EPA) Promulgated Reference Methods 13A and 13B in Appendix A to 40 CFR Part 60. Methods 13A and 13B prescribe testing and analysis procedures for fluoride emissions from stationary sources. After promulgation of the methods, EPA continued to evaluate them and as a result has determined the need for certain amendments to improve the accuracy and precision of the methods.

Methods 13A and 13B require assembly of the fluoride sampling train so that the filter is located either between the third and fourth impingers or in an optional location between the probe and first impinger. They also specify that a fritted glass disc be used to support the filter. Since promulgation of the methods, EPA has found that when a glass frit filter support is used in the optional filter location, some of the fluoride sample is retained on the glass. Although no tests have been performed, it is believed that fluoride retention may also occur if a sintered metal frit filter support is used. However, in tests performed using a 20 mesh stainless steel screen as a filter support no fluoride retention was noted. Therefore, to eliminate the possibility of fluoride retention, sections 5.1.5 and 7.1.3 of Methods 13A and 13B are being revised to require the use of a 20 mesh stainless steel screen filter support if the filter is located between the probe and first impinger. If the filter is located in the normal position between the third and fourth impingers, the glass frit filter support may still be used.

In addition to the changes to sections 5.1.5 and 7.1.3, a few corrections are also being made. The amendments promulgated herein are effective on November 29, 1976. EPA finds that good cause exists for not publishing this action as a notice of proposed rulemaking and for making it effective immediately upon publication because:

1. The action is intended to improve the accuracy and precision of Methods 13A and 13B and does not alter the overall substantive content of the methods or the stringency of standards of performance for fluoride emissions.

2. The amended methods may be used immediately in source testing for fluoride emissions.

Dated: November 17, 1976.

JOHN QUARLES,
Acting Administrator.

In Part 60 of Chapter I, Title 40 of the Code of Federal Regulations, Appendix A is amended as follows:

1. Reference Method 13A is amended as follows:

(a) In section 3., the phrase "300 μg/liter" is corrected to read "300 mg/liter" and the parenthetical phrase "(see section 7.3.6)" is corrected to read "(see section 7.3.4)".

(b) Section 5.1.5 is revised to read as follows:

> 5.1.5 Filter holder—If located between the probe and first impinger, borosilicate glass with a 20 mesh stainless steel screen filter support and a silicone rubber gasket; neither a glass frit filter support nor a sintered metal filter support may be used if the filter is in front of the impingers. If located between the third and fourth impingers, borosilicate glass with a glass frit filter support and a silicone rubber gasket. Other materials of construction may be used with approval from the Administrator, e.g., if probe liner is stainless steel, then filter holder may be stainless steel. The holder design shall provide a positive seal against leakage from the outside or around the filter.

(c) Section 7.1.3 is amended by revising the first two sentences of the sixth paragraph to read as follows:

> 7.1.3 Preparation of collection train. * * * Assemble the train as shown in Figure 13A-1 with the filter between the third and fourth impingers. Alternatively, the filter may be placed between the probe and first impinger if a 20 mesh stainless steel screen is used for the filter support. * * *

* * * * *

(d) In section 7.3.4, the reference in the first paragraph to "section 7.3.6" is corrected to read "section 7.3.5".

2. Reference Method 13B is amended as follows:

(a) In the third line of section 3, the phrase "300μg/liter" is corrected to read "300 mg/liter".

(b) Section 5.1.5 is revised to read as follows:

> 5.1.5 Filter holder—If located between the probe and first impinger, borosilicate glass with a 20 mesh stainless steel screen filter support and a silicone rubber gasket; neither a glass frit filter support nor a sintered metal filter support may be used if the filter is in front of the impingers. If located between the third and fourth impingers, borosilicate glass with a glass frit filter support and a silicone rubber gasket. Other materials of construction may be used with approval from the Administrator, e.g., if probe liner is stainless steel, then filter holder may be stainless steel. The holder design shall provide a positive seal against leakage from the outside or around the filter.

(c) Section 7.1.3 is amended by revising the first two sentences of the sixth paragraph to read as follows:

> 7.1.3 Preparation of collection train. * * * Assemble the train as shown in Figure 13A-1 (Method 13A) with the filter between the third and fourth impingers. Alternatively, the filter may be placed between the probe the first impinger if a 20 mesh stainless steel screen is used for the filter support. * * *

* * * * *

(d) In section 7.3.4, the reference in the first paragraph to "section 7.3.6" is corrected to read "section 7.3.5".

(Secs. 111, 114, and 301(a) Clean Air Act, as amended by sec. 4(a) of Pub. L. 91-604, 84 Stat. 1678 and by sec. 15(c)(2) of Pub. L. 91-604, 84 Stat. 1713 (42 U.S.C. 1857c-6, 1957c-9, and 1857g(2)).)

[FR Doc.76-34888 Filed 11-26-76;8:45 am]

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Title 40—Protection of Environment

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

SUBCHAPTER C—AIR PROGRAMS

[FRL 651-5]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Delegation of Authority to Pima County Health Department On Behalf of Pima County Air Pollution Control District

Pursuant to the delegation of authority for the standards of performance for new stationary sources (NSPS) to the Pima County Health Department on behalf of the Pima County Air Pollution Control District, dated October 7, 1976, EPA is today amending 40 CFR 60.4 Address, to reflect this delegation. A document announcing this delegation is published today at 41 FR in the Notices section of this issue. The amended § 60.4 is set forth below. It adds the address of the Pima County Air Pollution Control District, to which must be addressed all reports, requests, applications, submittals, and communications pursuant to this part by sources subject to the NSPS located within this Air Pollution Control District.

The Administrator finds good cause for foregoing prior public notice and for making this rulemaking effective immediately in that it is an administrative change and not one of substantive content. No additional substantive burdens are imposed on the parties affected. The delegation which is reflected by this administrative amendment was effective on October 7, 1976 and it serves no purpose to delay the technical change on this addition of the Air Pollution Control District's address to the Code of Federal Regulations.

This rulemaking is effective immediately, and is issued under the authority of Section 111 of the Clean Air Act, as amended (42 U.S.C. 1857c–6).

Dated: November 19, 1976.

R. L. O'CONNELL,
Acting Regional Administrator,
Environmental Protection
Agency, Region IX.

Part 60 of Chapter I, Title 40 of the Code of Federal Regulations is amended as follows:

1. In § 60.4 paragraph (b) is amended by adding subparagraph D to read as follows:

§ 60.4 Address.

* * * * *

(3) * * *

(A)-(C) * * *

D—Arizona

Pima County Air Pollution Control District, 151 West Congress Street, Tucson, AZ 85701

* * * * *

[FR Doc.76-35562 Filed 12-2-76;8:45 am]

FEDERAL REGISTER, VOL. 41, NO. 234
FRIDAY, DECEMBER 3, 1976

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[FRL 657-2]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Delegation of Authority to State of California on Behalf of San Diego County Air Pollution Control District

Pursuant to the delegation of authority for the standards of performance for new stationary sources (NSPS) to the State of California on behalf of the San Diego County Air Pollution Control District, dated November 8, 1976, EPA is today amending 40 CFR 60.4 Address, to reflect this delegation. A Notice announcing this delegation is published in the Notices section of this issue, under EPA (FR Doc. 76–36929 at page 54798). The amended § 60.4 is set forth below. It adds the address of the San Diego County Air Pollution Control District, to which must be addressed all reports, requests, applications, submittals, and communications pursuant to this part by sources subject to the NSPS located within this Air Pollution Control District.

The Administrator finds good cause for foregoing prior public notice and for making this rulemaking effective immediately in that it is an administrative change and not one of substantive content. No additional substantive burdens are imposed on the parties affected. The delegation which is reflected in this administrative amendment was effective on November 8, 1976 and it serves no purpose to delay the technical change on this addition of the Air Pollution Control District's address to the Code of Federal Regulations.

This rulemaking is effective immediately, and is issued under the authority of section 111 of the Clean Air Act, as amended (42 U.S.C. 1857c–6).

Dated: November 26, 1976.

SHELIA M. PRINDIRVILLE,
Acting Regional Administrator,
Environmental Protection
Agency, Region IX.

Part 60 of Chapter I, Title 40 of the Code of Federal Regulations is amended as follows:

1. In § 60.4 paragraph (b) is amended by revising subparagraph F to read as follows:

§ 60.4 Address.

* * * * *

(b) * * *

(A)-(E) * * *

F—California:

Bay Area Air Pollution Control District, 939 Ellis Street, San Francisco, CA 94109.

Del Norte County Air Pollution Control District, Courthouse, Crescent City, CA 95531.

Fresno County Air Pollution Control District, 515 S. Cedar Avenue, Fresno, CA 93702.

Humboldt County Air Pollution Control District, 5600 S. Broadway, Eureka, CA 95501.

Kern County Air Pollution Control District, 1700 Flower Street (P.O. Box 997), Bakersfield, CA 93302.

Madera County Air Pollution Control District, 135 W. Yosemite Avenue, Madera, CA 93637.

Mendocino County Air Pollution Control District, County Courthouse, Ukiah, CA 95482.

Monterey Bay Unified Air Pollution Control District, 420 Church Street (P.O. Box 487) Salinas, CA 93901.

Northern Sonoma County Air Pollution Control District, 3313 Chanate Road, Santa Rosa, CA 95404.

Sacramento County Air Pollution Control District, 3701 Branch Center Road, Sacramento, CA 95827.

San Diego County Air Pollution Control District, 9150 Chesapeake Drive, San Diego, CA 92123.

San Joaquin County Air Pollution Control District, 1601 E. Hazelton Street (P.O. Box 2009) Stockton, CA 95201.

Santa Barbara County Air Pollution Control District, 4440 Calle Real, Santa Barbara, CA 93110.

Stanislaus County Air Pollution Control District, 820 Scenic Drive, Modesto, CA 95350.

Trinity County Air Pollution Control District, Box AJ, Weaverville, CA 96093.

Ventura County Air Pollution Control District, 625 E. Santa Clara Street, Ventura, CA 93001.

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[FR Doc.76 36925 Filed 12-14-76;8:45 am]

FEDERAL REGISTER, VOL. 41, NO. 242
WEDNESDAY, DECEMBER 15, 1976

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[FRL 661-6]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Delegation of Authority to the State of Ohio

Pursuant to the delegation of authority to implement the standards of performance for new stationary sources (NSPS) to the State of Ohio on August 4, 1976, EPA is today amending 40 CFR 60.4, Address to reflect this delegation. A Notice announcing this delegation is published in the Notices section of this issue of the FEDERAL REGISTER (FR Doc. 76-37487). The amended § 60.4 is set forth below which adds the addresses of the Agencies in Ohio which assist the State in the delegated authority to that list of addresses to which all reports, requests, applications, submittals, and communications to the Administrator pursuant to this part must be sent.

The Administrator finds good cause for foregoing prior notice and for making this rulemaking effective immediately in that it is an administrative change and not one of substantive content. No additional substantive burdens are imposed on the parties affected. The delegation which is reflected by this administrative amendment was effective on August 4, 1976, and it serves no purpose to delay the technical change of this addition of the addresses to the Code of Federal Regulations.

This rulemaking is effective immediately, and is issued under the authority of section 111 of the Clean Air Act, as amended.

(42 U.S.C. 1857c-6.)

Dated: December 10, 1976.

GEORGE R. ALEXANDER, Jr.,
Regional Administrator.

Part 60 of Chapter I, Title 40 of the Code of Federal Regulations is amended as follows:

1. In § 60.4, paragraph (b) is amended by revising subparagraph KK. to read as follows:

§ 60.1 Address.

* * * * *

(b) * * *

(A)-(JJ) * * *

(KK) Ohio—

Medina, Summit and Portage Counties; Director, Air Pollution Control, 177 South Broadway, Akron, Ohio, 44308.

Stark County; Director, Air Pollution Control Division, Canton City Health Department, City Hall, 218 Cleveland Avenue SW, Canton, Ohio, 44702.

Butler, Clermont, Hamilton and Warren Counties; Superintendent, Division of Air Pollution Control, 2400 Beekman Street, Cincinnati, Ohio, 45214.

Cuyahoga County; Commissioner, Division of Air Pollution Control, Department of Public Health and Welfare, 2735 Broadway Avenue, Cleveland, Ohio, 44115.

Lorain County; Control Officer, Division of Air Pollution Control, 200 West Erie Avenue, 7th Floor, Lorain, Ohio, 44052.

Belmont, Carroll, Columbiana, Harrison, Jefferson, and Monroe Counties; Director, North Ohio Valley Air Authority (NOVAA), 814 Adams Street, Steubenville, Ohio, 43952.

Clark, Darke, Greene, Miami, Montgomery, and Preble Counties; Supervisor, Regional Air Pollution Control Agency (RAPCA), Montgomery County Health Department, 451 West Third Street, Dayton, Ohio, 45402.

Lucas County and the City of Rossford (in Wood County): Director, Toledo Pollution Control Agency, 26 Main Street, Toledo, Ohio, 43605.

Adams, Brown, Lawrence, and Scioto Counties: Engineer-Director, Air Division, Portsmouth City Health Department, 740 Second Street, Portsmouth, Ohio, 45662

Allen, Ashland, Auglaize, Crawford, Defiance, Erie, Fulton, Hancock, Hardin, Henry, Huron, Knox, Marion, Mercer, Morrow, Ottawa, Paulding, Putnam, Richland, Sandusky, Seneca, Van Wert, Williams, Wood (except City of Rossford), and Wyandot Counties; Ohio Environmental Protection Agency, Northwest District Office, 111 West Washington Street, Bowling Green, Ohio, 43402.

Ashtabula, Geauga, Lake, Mahoning, Trumbull, and Wayne Counties; Ohio Environmental Protection Agency, Northeast District Office, 2110 East Aurora Road, Twinsburg, Ohio, 44087.

Athens, Coshocton, Gallia, Guernsey, Highland, Hocking, Holmes, Jackson, Meigs, Morgan, Muskingum, Noble, Perry, Pike, Ross, Tuscarawas, Vinton, and Washington Counties; Ohio Environmental Protection Agency, Southeast District Office, Route 3, Box 603, Logan, Ohio, 43138.

Champaign, Clinton, Logan, and Shelby Counties: Ohio Environmental Protection Agency, Southwest District Office, 7 East Fourth Street, Dayton, Ohio, 45402.

Delaware, Fairfield, Fayette, Franklin, Licking, Madison, Pickaway, and Union Counties; Ohio Environmental Protection Agency, Central District Office, 369 East Broad Street, Columbus, Ohio, 43215.

* * * * *

[FR Doc 76-37488 Filed 12-20-76;8:45 am]

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(FRL 665-1)

SUBCHAPTER C—AIR PROGRAMS

DELEGATION OF AUTHORITY—NEW SOURCE REVIEW

Delegation of Authority to the State of North Carolina

The amendments below institute certain address changes for reports and applications required from operators of new sources. EPA has delegated to the State of North Carolina authority to review new and modified sources. The delegated authority includes the reviews under 40 CFR Part 52 for the prevention of significant deterioration. It also includes the reviews under 40 CFR Part 60 for the standards of performance for new stationary sources and reviews under 40 CFR Part 61 for national emission standards for hazardous air pollutants.

A notice announcing the delegation of authority is published elsewhere in this issue of the FEDERAL REGISTER. These amendments provide that all reports, requests, applications, submittals, and communications previously required for the delegated reviews will now be sent instead to the North Carolina Environmental Management Commission, Department of Natural and Economic Resources, Division of Environmental Management, P.O. Box 27687, Raleigh, North Carolina 27611. Attention: Air Quality Section, instead of EPA's Region IV.

The Regional Administrator finds good cause for foregoing prior public notice and for making this rulemaking effective immediately in that it is an administrative change and not one of substantive content. No additional substantive burdens are imposed on the parties affected. The delegation which is reflected by this administrative amendment was effective on November 24, 1976, and it serves no purpose to delay the technical change of this addition of the State address to the Code of Federal regulations.

This rulemaking is effective immediately, and is issued under the authority of Sections 101, 110, 111, 112, and 301 of the Clean Air Act, as amended, 42 U.S.C. 1857, 1857c-5, 6, 7 and 1857g.

Dated: December 21, 1976.

JOHN A. LITTLE,
Deputy Regional Administrator.

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

2. Part 60 of Chapter I, Title 40, Code of Federal Regulations, is amended as follows: In § 60.4, paragraph (b) is amended by revising subparagraph (II) to read as follows:

§ 60.1 Address.

* * * * *

(b) * * *

(A)-(HH) * * *

(II) North Carolina Environmental Management Commission, Department of Natural and Economic Resources, Division of Environmental Management, P.O. Box 27687, Raleigh, North Carolina 27611. Attention: Air Quality Section.

* * * * *

SUBCHAPTER C—AIR PROGRAMS

[FRL 664-3]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Delegation of Authority to State of Nebraska

Pursuant to the delegation of authority for the Standards of Performance for New Stationary Sources (NSPS), to the State of Nebraska on November 24, 1975, the Environmental Protection Agency (EPA) is today amending 40 CFR 60.4, [Address.], to reflect this delegation. A notice announcing this delegation is published (December 30, 1976), in the FEDERAL REGISTER. Effective immediately all requests, reports, applications, submittals, and other communications concerning the 12 source categories of the

NSPS which were promulgated December 23, 1971, and March 8, 1974, shall be sent to Nebraska Department of Environmental Control (DEC), P.O. Box 94653, State House Station, Lincoln, Nebraska 68509. However, reports required pursuant to 40 CFR 60.7(a) shall be sent to EPA, Region VII, 1735 Baltimore, Kansas City, Missouri 64108, as well as to the State.

The Regional Administrator finds good cause for forgoing prior public notice and making this rulemaking effective immediately in that it is an administrative change and not one of substantive content. No additional substantive burdens are imposed on the parties affected. This delegation, which is reflected by this administrative amendment, was effective on November 24, 1975, and it serves no purpose to delay the technical change of this addition of the State address to the Code of Federal Regulations.

This rulemaking is effective immediately, and is issued under the authority of Section 111 of the Clean Air Act, as amended.

(42 U.S.C. 1857c-6.)

Dated: December 20, 1976.

JEROME H. SVORE,
Regional Administrator.

Part 60 of Chapter I, Title 40 of the Code of Federal Regulations is amended as follows:

1. In § 60.4 paragraph (b) is amended by revising subparagraph (CC) to read as follows:

§ 60.4 Address.

* * * * *

(b) * * *

(A)-(BB) * * *

(CC) Nebraska Department of Environmental Control, P.O. Box 94653, State House Station, Lincoln, Nebraska 68509.

[FR Doc.76-38234 Filed 12-29-76;8:45 am]

[FRL 664-6]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Delegation of Authority to the State of Iowa

Pursuant to the delegation of authority for New Source Performance Standards (NSPS) to the State of Iowa on June 6, 1975, the Environmental Protection Agency is today amending 40 CFR 60.4, [Address.] to reflect this delegation. A notice announcing this delegation is published (December 30, 1976), in the FEDERAL REGISTER.

The amended § 60.4 provides that all reports, requests, applications, submittals, and other communications required for the 11 source categories of the NSPS, which were delegated to the State, shall be sent to the Iowa Department of Environmental Quality (DEQ), 3920 Delaware Avenue, P.O. Box 3326, Des Moines, Iowa 50316. However, reports required pursuant to 40 CFR 60.7(a) shall be sent to EPA, Region VII, 1735 Baltimore, Kansas City, Missouri 64108, as well as to the State.

The Regional Administrator finds good cause to forgo prior public notice and make this rulemaking effective immediately in that it is an administrative change and not one of substantive content. The delegation was effective June 6, 1975, and it serves no purpose to delay the technical change of the addition of the State address to the Code of Federal Regulations.

This rulemaking is effective immediately and is issued under the authority of Section 111 of the Clean Air Act, as amended.

(42 U.S.C. 1857c-6.)

Dated: December 20, 1976.

JEROME H. SVORE,
Regional Administrator.

Part 60 of Chapter I, Title 40 of the Code of Federal Regulations is amended as follows:

1. In § 60.4, paragraph (b) is amended by revising subparagraph Q. to read as follows:

§ 60.4 Address.

* * * * *

(b) * * *

(A)-(P) * * *

(Q) State of Iowa, Department of Environmental Quality, 3920 Delaware, P.O. Box 3326, Des Moines, Iowa 50316.

* * * * *

[FR Doc.76-38241 Filed 12-29-76;8:45 am]

FEDERAL REGISTER, VOL. 41, NO. 252

THURSDAY, DECEMBER 30, 1976

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Title 40—Protection of Environment

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

SUBCHAPTER C—AIR PROGRAMS

[FRL 668-1]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCE

Delegation of Authority to State of Vermont

Pursuant to the delegation of authority for the Standards of Performance for New Stationary Sources (NSPS) to the State of Vermont on September 3, 1976, EPA is today amending 40 CFR 60.4, *Address*, to reflect this delegation. A notice announcing this delegation is published today in the FEDERAL REGISTER. (See FR Doc. 77-546 appearing in the Notices section of this issue). The amended § 60.4, which adds the address of the Vermont Agency of Environmental Protection to which all reports, requests, applications, submittals, and communications to the Administrator pursuant to this part must also be addressed, is set forth below.

The Administrator finds good cause for foregoing prior public notice and for making this rulemaking effective immediately in that it is an administrative change and not one of substantive content. No additional substantive burdens are imposed on the parties affected. The delegation which is reflected by this administrative amendment was effective on September 3, 1976, and it serves no purpose to delay the technical change of this addition to the State address to the Code of Federal Regulations.

This rulemaking is effective immediately, and is issued under the authority of Section 111 of the Clean Air Act, as amended. 42 U.S.C. 1857c-6.

Dated: December 17, 1976.

JOHN A. S. MCGLENNON,
Regional Administrator.

Part 60 of Chapter I, Title 40 of the Code of Federal Regulations is amended as follows:

1. In § 60.4 paragraph (b) is amended by revising subparagraph (UU) to read as follows:

§ 60.4 Address.

* * * * *

(b) * * *

(UU) State of Vermont, Agency of Environmental Protection, Box 489, Montpelier, Vermont 05602.

* * * * *

[FR Doc.77-547 Filed 1-5-77;8:45 am]

FEDERAL REGISTER, VOL. 42, NO. 4

THURSDAY, JANUARY 6, 1977

Title 40—Protection of Environment

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

SUBCHAPTER C—AIR PROGRAMS

[FRL 673-6]

NEW SOURCE REVIEW

Delegation of Authority to the State of South Carolina

The amendments below institute certain address changes for reports and applications required from operators of new sources. EPA has delegated to the State of South Carolina authority to review new and modified sources. The delegated authority includes the reviews under 40 CFR Part 52 for the prevention of significant deterioration. It also includes the review under 40 CFR Part 60 for the standards of performance for new stationary sources and review under 40 CFR Part 61 for national emission standards for hazardous air pollutants.

A notice announcing the delegation of authority is published elsewhere in the notices section of this issue of the FEDERAL REGISTER. These amendments provide that all reports, requests, applications, submittals, and communications previously required for the delegated reviews will now be sent to the Office of Environmental Quality Control, Departpartment of Health and Environmental Control, 2600 Bull Street, Columbia, South Carolina 29201, instead of EPA's Region IV.

The Regional Administrator finds good cause for foregoing prior public notice and for making this rulemaking effective immediately in that it is an administrative change and not one of substantive content. No additional substantive burdens are imposed on the parties affected. The delegation which is reflected by this administrative amendment was effective on October 19, and it serves no purpose to delay the technical change of this addition of the State address to the Code of Federal Regulations.

This rulemaking is effective immediately, and is issued under the authority of sections 101, 110, 111, 112, and 301 of the Clean Air Act, as amended, 42 U.S.C. 1857c-5, 6, 7 and 1857g.

Dated: January 11, 1977.

JOHN A. LITTLE,
Acting Regional Administrator.

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

DELEGATION OF AUTHORITY TO THE STATE OF SOUTH CAROLINA

3. Part 60 of Chapter I, Title 40, Code of Federal Regulations, is amended by revising subparagraph (PP) of § 60.4(b) to read as follows:

§ 60.4 Address.

* * * * *

(b) * * *

(A)-(OO) * * *

(PP) State of South Carolina, Office of Environmental Quality Control, Department of Health and Environmental Control, 2600 Bull Street, Columbia, South Carolina 29201.

ENVIRONMENTAL PROTECTION AGENCY

[FRL 675-4]

AIR PROGRAMS—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Receipt of Application and Approval of Alternative Performance Test Method

On January 26, 1976 (41 FR 3826), the Environmental Protection Agency (EPA) promulgated standards of performance for new primary aluminum reduction plants under 40 CFR Part 60. The standards limit air emissions of gaseous and particulate fluorides from new and modified primary aluminum reduction plants. The owners or operators of affected facilities are required to determine compliance with these standards by conducting a performance test as specified in Appendix A—Reference Methods, Method 13A or 13B, "Determination of Total Fluoride Emissions from Stationary Sources" published in the FEDERAL REGISTER August 6, 1975 (40 FR 33157). As provided in 40 CFR 60.8(b), (2) and (3), the Administrator may approve the use of an equivalent test method or may approve the use of an alternative method if the method has been shown to be adequate for the determination of compliance with the standard. Method 13A specified that total fluorides be determined by the SPADNS Zirconium Lake colormetric method, and Method 13B specified that this determination be made by the specific ion electrode method.

On September 3, 1976, EPA received written application for approval of equivalency for a third analytical technique from Kaiser Aluminum and Chemical Corporation, Oakland, California. Specifically, the application requested approval of ASTM Method D 3270-73T, "Tentative Method of Analysis for Fluoride Content of the Atmosphere and Plant Tissues," 1974 Annual Book of ASTM Standards—Part 26.

Specific guidelines for the determination of method equivalency have not been established by EPA. However, EPA has completed a technical review of the application and has determined that the ASTM method will produce results adequate for the determination of compliance with the standards of performance for new primary aluminum plants. Therefore, EPA approves the ASTM method as an alternative to the analytical procedures specified in paragraph 7.3 "Analysis" of Method 13A or 13B for aluminum plants, pursuant to 40 CFR 60.8(b)(3).

Dated: January 18, 1977.

ROGER STRELOW,
Assistant Administrator for Air and Waste Management.

[FR Doc.77-2385 Filed 1-25-77;8:45 am]

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Title 40 - Protection of Environment

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

[FRL 669-4]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Revisions to Emission Monitoring Requirements and to Reference Methods

On October 6, 1975 (40 FR 46250), under sections 111, 114, and 301 of the Clean Air Act, as amended, the Environmental Protection Agency (EPA) promulgated emission monitoring requirements and revisions to the performance testing Reference Methods in 40 CFR Part 60. Since that time, EPA has determined that there is a need for a number of revisions to clarify the requirements. Each of the revisions being made in 40 CFR Part 60 are discussed as follows:

1. *Section 60.13*. Paragraph (c)(3) has been rewritten to clarify that not only new monitoring systems but also upgraded monitoring systems must comply with applicable performance specifications.

Paragraph (e)(1) is revised to provide that data recording is not required more frequently than once every six minutes (rather than the previously required ten seconds) for continuous monitoring systems measuring the opacity of emissions. Since reports of excess emissions are based upon review of six-minute averages, more frequent data recording is not required in order to satisfy these monitoring requirements.

2. *Section 60.45*. Paragraphs (a) through (e) have been reorganized for clarification. In addition, restrictions on use of continuous monitoring systems for measuring oxygen on a wet basis have been removed. Prior to this revision, only dry basis oxygen monitoring equipment was acceptable. Procedures for use of wet basis oxygen monitoring equipment have been approved by EPA and were published in the FEDERAL REGISTER as an alternative procedure (41 FR 44838).

Also deleted from § 60.45 are restrictions on the location of a carbon dioxide (CO_2) continuous monitoring system downstream of wet scrubber flue gas desulfurization equipment. At the time the regulations were promulgated (October 6, 1975), EPA thought that limestone scrubbers were operated under conditions that could cause significant generation or absorption of CO_2 by the scrubbing solution which would cause errors in the monitoring results. EPA investigated this potential problem and concluded that lime or limestone scrubbers under typical conditions of operation do not significantly alter the concentration of CO_2 in the flue gas and would not introduce significant errors into the monitoring results. Lime scrubbers operate at a pH level between 7 and 8 which will maximize SO_2 absorption and minimize CO_2 absorption. Thus, the effect of CO_2 loss on the emission results is expected to be minimal. The exact amount of CO_2 loss, if any, during the scrubber operation has not been determined since it is dependent upon the operating conditions for a particular facility. Although each percent of CO_2 absorption will result in a positive bias of 7.1 percent (at a stack concentration of 14 percent CO_2) in the final emission results, i.e. the indicated results may be higher than actual stack concentrations, the actual bias is expected to be very small since the amount of CO_2 absorption will be much less than one percent.

In flue gases from limestone scrubbers, there exists a possibility of the addition of CO_2 from the scrubbing reaction to the CO_2 from the fuel combustion. Every two molecules of SO_2 reacting with the limestone will produce a molecule of CO_2. Limestone scrubbers are typically operated at an approximate temperature of 50° C under acidic conditions. At these operating conditions the amount of CO_2 generated in a 90 percent efficiency scrubber is 1350 ppm or 0.135 percent CO_2. This will introduce a negative bias of 1 to 1.5 percent for a CO_2 level of 8 to 15 percent. This amount of potential error compares favorably with systems previously approved. Therefore, EPA is removing the restrictions which limited the installation of carbon dioxide continuous monitoring systems to a location upstream of the scrubber.

Several other revisions are being made to paragraphs (a), (b), (c), and (e) of Subpart D which improve the clarity or further define the intent of the regulations. Paragraph (d) has been reserved for later addition of fuel monitoring provisions.

3. *Performance Specification 1*. Paragraph 6.2 has been rewritten to clarify requirements that must be met by continuous opacity monitor manufacturers. Manufacturers must certify that at least one analyzer from each month's production was tested and meets all applicable requirements. If any requirements are not met, the production for the month must be resampled according to military standard 105D (MIL-STD-105D) and retested. Previously the regulation required that each unit of production had to be tested. Copies of MIL-STD-105D may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

4. *Performance Specification 2*. Figure 2-3 of Performance Specification 2 has been corrected to properly define the term "mean differences." The corrections in the operations now conform with the statistical definitions of the specifications.

5. *General*. These amendments provide optional monitoring procedures that may be selected by an owner or operator of a facility affected by the monitoring requirements of 40 CFR Part 60. Certain editorial clarifications are also included. Proposal of these amendments is not necessary because the changes are either interpretative in nature, or represent minor changes in instrumentation testing and data recording, or allow a wider selection of equipment to be used. These changes will have no effect upon the number of emission sources that must be monitored or the quality of the resultant emission data. The changes are consistent with recent determinations of the Administrator with respect to use of alternative continuous monitoring systems.

6. *Effective date*. These revisions become effective March 2, 1977.

(Secs. 111, 114, 301(a), Clean Air Act, as amended, Pub. L. 91-604, 84 Stat. 1678 (42 U.S.C. 1857c-6, 1857c-9, 1857g(a)).)

NOTE.—The Environmental Protection Agency has determined that this document does not contain a major proposal requiring preparation of an Inflation Impact Statement under Executive Order 11821 and OMB Circular A-107.

Dated: January 19, 1977.

JOHN QUARLES,
Acting Administrator.

In 40 CFR Part 60 Subpart A, Subpart D, and Appendix B are amended as follows:

Subpart A—General Provisions

1. Section 60.13 is amended by revising paragraphs (c)(3) and (e)(1) as follows:

§ 60.13 Monitoring requirements.

* * * * *

(c) * * *

(3) All continuous monitoring systems referenced by paragraph (c)(2) of this section shall be upgraded or replaced (if necessary) with new continuous monitoring systems, and the new or improved systems shall be demonstrated to comply with applicable performance specifications under paragraph (c)(1) of this section on or before September 11, 1979.

* * * * *

(e) * * *

(1) All continuous monitoring systems referenced by paragraphs (c)(1) and (c)(2) of this section for measuring opacity of emissions shall complete a minimum of one cycle of sampling and analyzing for each successive ten-second period and one cycle of data recording for each successive six-minute period.

* * * * *

Subpart D—Standards of Performance for Fossil Fuel-Fired Steam Generators

2. Section 60.45 is amended by revising paragraphs (a), (b), (c), and (e) and by reserving paragraph (d) as follows:

§ 60.45 Emission and fuel monitoring.

(a) Each owner or operator shall install, calibrate, maintain, and operate continuous monitoring systems for measuring the opacity of emissions, sulfur dioxide emissions, nitrogen oxides emissions, and either oxygen or carbon dioxide except as provided in paragraph (b) of this section.

(b) Certain of the continuous monitoring system requirements under paragraph (a) of this section do not apply to owners or operators under the following conditions:

(1) For a fossil fuel-fired steam generator that burns only gaseous fossil fuel, continuous monitoring systems for measuring the opacity of emissions and sulfur dioxide emissions are not required.

(2) For a fossil fuel-fired steam generator that does not use a flue gas desulfurization device, a continuous monitoring system for measuring sulfur dioxide emissions is not required if the owner or operator monitors sulfur dioxide emissions by fuel sampling and analysis under paragraph (d) of this section.

(3) Notwithstanding § 60.13(b), installation of a continuous monitoring system for nitrogen oxides may be delayed until after the initial performance tests under § 60.8 have been conducted. If the owner or operator demonstrates during the performance test that emissions of nitrogen oxides are less than 70 percent of the applicable standards in § 60.44, a continuous monitoring system for measuring nitrogen oxides emissions is not required. If the initial performance test results show that nitrogen oxide emissions are greater than 70 percent of the applicable standard, the owner or operator shall install a continuous monitoring system for nitrogen oxides within one year after the date of the initial performance tests under § 60.8 and comply with all other applicable monitoring requirements under this part.

(4) If an owner or operator does not install any continuous monitoring systems for sulfur oxides and nitrogen oxides, as provided under paragraphs (b)(1) and (b)(3) or paragraphs (b)(2) and (b)(3) of this section a continuous monitoring system for measuring either oxygen or carbon dioxide is not required.

(c) For performance evaluations under § 60.13(c) and calibration checks under § 60.13(d), the following procedures shall be used:

(1) Reference Methods 6 or 7, as applicable, shall be used for conducting performance evaluations of sulfur dioxide and nitrogen oxides continuous monitoring systems.

(2) Sulfur dioxide or nitric oxide, as applicable, shall be used for preparing calibration gas mixtures under Performance Specification 2 of Appendix B to this part.

(3) For affected facilities burning fossil fuel(s), the span value for a continuous monitoring system measuring the opacity of emissions shall be 80, 90, or 100 percent and for a continuous monitoring system measuring sulfur oxides or nitrogen oxides the span value shall be determined as follows:

[In parts per million]

Fossil fuel	Span value for sulfur dioxide	Span value for nitrogen oxides
Gas	(1)	500
Liquid	1,000	500
Solid	1,500	500
Combinations	$1{,}000y+1{,}500z$	$500(x+y)+1{,}000z$

(1) Not applicable.

where:

x = the fraction of total heat input derived from gaseous fossil fuel, and

y = the fraction of total heat input derived from liquid fossil fuel, and

z = the fraction of total heat input derived from solid fossil fuel.

(4) All span values computed under paragraph (c)(3) of this section for burning combinations of fossil fuels shall be rounded to the nearest 500 ppm.

(5) For a fossil fuel-fired steam generator that simultaneously burns fossil fuel and nonfossil fuel, the span value of all continuous monitoring systems shall be subject to the Administrator's approval.

(d) [Reserved]

(e) For any continuous monitoring system installed under paragraph (a) of this section, the following conversion procedures shall be used to convert the continuous monitoring data into units of the applicable standards (ng/J, lb/million Btu):

(1) When a continuous monitoring system for measuring oxygen is selected, the measurement of the pollutant concentration and oxygen concentration shall each be on a consistent basis (wet or dry). Alternative procedures approved by the Administrator shall be used when measurements are on a wet basis. When measurements are on a dry basis, the following conversion procedure shall be used:

$$E=CF\left[\frac{20.9}{20.9-\text{percent }O_2}\right]$$

where:

E, C, F, and %O_2 are determined under paragraph (f) of this section.

(2) When a continuous monitoring system for measuring carbon dioxide is selected, the measurement of the pollutant concentration and carbon dioxide concentration shall each be on a consistent basis (wet or dry) and the following conversion procedure shall be used:

$$E=CF_c\left[\frac{100}{\text{percent }CO_2}\right]$$

where:

E, C, F_c and %CO_2 are determined under paragraph (f) of this section.

Appendix B—Performance Specifications

3. Performance Specification 1 is amended by revising paragraph 6.2 as follows:

* * * * *

6. * * *

6.2 Conformance with the requirements of section 6.1 may be demonstrated by the owner or operator of the affected facility by testing each analyzer or by obtaining a certificate of conformance from the instrument manufacturer. The certificate must certify that at least one analyzer from each month's production was tested and satisfactorily met all applicable requirements. The certificate must state that the first analyzer randomly sampled met all requirements of paragraph 6 of this specification. If any of the requirements were not met, the certificate must show that the entire month's analyzer production was resampled according to the military standard 105D sampling procedure (MIL-STD-105D) inspection level II; was retested for each of the applicable requirements under paragraph 6 of this specification; and was determined to be acceptable under MIL-STD-105D procedures. The certificate of conformance must show the results of each test performed for the analyzers sampled during the month the analyzer being installed was produced.

* * * * *

4. Performance Specification 2 is amended by revising Figure 2-3 as follows:

Test No.	Date and Time	Reference Method Samples					Analyzer 1-Hour Average (ppm)*		Difference (ppm)	
		SO_2 Sample 1 (ppm)	NO Sample 1 (ppm)	NO Sample 2 (ppm)	NO Sample 3 (ppm)	NO Sample Average (ppm)	SO_2	NO_x	SO_2	NO_x
1										
2										
3										
4										
5										
6										
7										
8										
9										

Mean reference method test value (SO_2) ______

Mean reference method test value (NO_x) ______

Mean of the differences ______

95% Confidence intervals = ± ______ ppm (SO_2) = ± ______ ppm (NO_x)

$$\text{Accuracies} = \frac{\text{Mean of the differences} + \text{95\% confidence interval}}{\text{Mean reference method value}} \times 100 = \_\_\_\%\ (SO_2) = \_\_\_\%\ (NO_x)$$

* Explain and report method used to determine integrated averages

Figure 2-3. Accuracy Determination (SO_2 and NO_x)

(Secs. 111, 114, 301(a), Clean Air Act, as amended, Pub. L. 91-604, 84 Stat. 1678 (42 U.S.C. 1857c-6, 1857-9, 1857g(a))).

[FR Doc.77-2744 Filed 1-28-77;8:45 am]

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[FRL 682-4]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Delegation of Authority to City of Philadelphia

Pursuant to the delegation of authority for the standards of performance for new stationary sources (NSPS) to the City of Philadelphia on September 30, 1976, EPA is today amending 40 CFR 60.4, Address, to reflect this delegation. For a notice announcing this delegation, see FR Doc. 77-3712 published in the Notices section of today's FEDERAL REGISTER. The amended § 60.4, which adds the address of the Philadelphia Department of Public Health, Air Management Services, to which all reports, requests, applications, submittals, and communications to the Administrator pursuant to this part must also be addressed, is set forth below.

The Administrator finds good cause for foregoing prior public notice and for making this rulemaking effective immediately in that it is an administrative change and not one of substantive content. No additional substantive burdens are imposed on the parties affected. The delegation which is reflected by this Administrative amendment was effective on September 30, 1976, and it serves no purpose to delay the technical change of this address to the Code of Federal Regulations.

This rulemaking is effective immediately, and is issued under the authority of section 111 of the Clean Air Act, as amended, 42 U.S.C. 1857c-6.

Dated: January 25, 1977.

A. R. MORRIS,
Acting Regional Administrator.

Part 60 of Chapter I, Title 40 of the Code of Federal Regulations is amended as follows:

1. In § 60.4, paragraph (b) is amended by revising subparagraph (NN) to read as follows:

§ 60.4 Address.

* * * * *

(b) * * *

(A)-(MM) * * *

(NN) (a) City of Philadelphia: Philadelphia Department of Public Health, Air Management Services, 801 Arch Street, Philadelphia, Pennsylvania 19107.

* * * * *

[FR Doc.77-3700 Filed 2-3-77;8:45 am]

FEDERAL REGISTER, VOL. 42, NO. 24

FRIDAY, FEBRUARY 4, 1977

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PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Region V Address; Correction

Section 60.4 paragraph (a) is corrected by changing Region V (Illinois, Indiana, Minnesota, Michigan, Ohio, Wisconsin), 1 North Wacker Drive, Chicago, Illinois 60606 to Region V (Illinois, Indiana, Minnesota, Michigan, Ohio, Wisconsin), 230 South Dearborn Street, Chicago, Illinois 60604.

Dated: March 21, 1977.

GEORGE R. ALEXANDER, Jr.,
Regional Administrator.

[FR Doc.77-9406 Filed 3-29-77;8:45 am]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Delegation of Authority to the State of Wisconsin

Pursuant to the delegation of authority for the standards of performance for new stationary sources (NSPS) to the State of Wisconsin on September 28, 1976, EPA is today amending 40 CFR 60.4, Address, to reflect this delegation. A Notice announcing this delegation is published today, March 30, 1977, at 42 FR 16845 in this FEDERAL REGISTER. The amended § 60.4, which adds the address of the Wisconsin Department of Natural Resources to which all reports, requests, applications, submittals, and communications to the Administrator pursuant to this part must also be addressed, is set forth below.

The Administrator finds good cause for foregoing prior public notice and for making this rulemaking effective immediately in that it is an administrative change and not one of substantive content. No additional substantive burdens are imposed on the parties affected. The delegation which is reflected by this administrative amendment was effective on September 28, 1976 and it serves no purpose to delay the technical change of this addition of the State address to the Code of Federal Regulations.

This rulemaking is effective immediately, and is issued under the authority of section 111 of the Clean Air Act, as amended, 42 U.S.C. 1857c-6.

Dated: March 21, 1977.

GEORGE R. ALEXANDER, Jr.,
Regional Administrator.

Part 60 of Chapter I, Title 40 of the Code of Federal Regulations is amended as follows:

1. In § 60.4 paragraph (b) is amended by revising subparagraph (YY), to read as follows:

§ 60.4 Address.

* * * * *

(b) * * *

(A)-(XX) * * *

(YY) Wisconsin—

Wisconsin Department of Natural Resources, P.O. Box 7921, Madison, Wisconsin 53707.

[FR Doc.77-9404 Filed 3-29-77;8:45 am]

FEDERAL REGISTER, VOL. 42, NO. 61—WEDNESDAY, MARCH 30, 1977

60

Title 40—Protection of Environment

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

[FRL 718-8]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Compliance With Standards and Maintenance Requirements

AGENCY: Environmental Protection Agency.

ACTION: Final rule.

SUMMARY: This action amends the general provisions of the standards of performance to allow methods other than Reference Method 9 to be used as a means of measuring plume opacity. The Environmental Protection Agency (EPA) is investigating a remote sensing laser radar system of measuring plume opacity and believes it could be considered as an alternative method to Reference Method 9. This amendment would allow EPA to propose such systems as alternative methods in the future.

EFFECTIVE DATE: June 22, 1977.

FOR FURTHER INFORMATION CONTACT:

Don R. Goodwin, Emission Standards and Engineering Division, Environmental Protection Agency, Research Triangle Park, North Carolina 27711, telephone no. 919-688-8146, ext. 271.

SUPPLEMENTARY INFORMATION: As originally expressed, 40 CFR 60.11(b) permitted the use of Reference Method 9 exclusively for determining whether a source complied with an applicable opacity standard. By this action, EPA amends § 60.11(b) so that alternative methods approved by the Administrator may be used to determine opacity.

When § 60.11(b) was originally promulgated, the visible emissions (Method 9) technique of determining plume opacity with trained visible emission observers was the only expedient and accurate method available to enforcement personnel. Recently, EPA funded the development of a remote sensing laser radar system (LIDAR) that appears to produce results adequate for determination of compliance with opacity standards. EPA is currently evaluating the equipment and is considering proposing its use as an alternative technique of measuring plume opacity.

This amendment will allow EPA to consider use of the LIDAR method of determining plume opacity and, if appropriate, to approve this method for enforcement of opacity regulations. If this method appears to be a suitable alternative to Method 9, it will be proposed in the FEDERAL REGISTER for public comment. After considering comments, EPA will determine if the new method will be an acceptable means of determining opacity compliance.

(Secs. 111, 114, 301(a), Clean Air Act, sec. 4(a) of Pub. L. 91-604, 84 Stat. 1683; sec. 4(a) of Pub. L. 91-604, 84 Stat. 1687; sec. 2 of Pub. L. No. 90-148, 81 Stat. 504 (42 U.S.C. 1857c-6, 1857c-9 and 1857g(a)).)

NOTE.—Economic Impact Analysis: The Environmental Protection Agency has determined that this action does not contain a major proposal requiring preparation of an Economic Impact Analysis under Executive Orders 11821 and 11949 and OMB Circular A-107.

Dated: May 10, 1977.

DOUGLAS M. COSTLE,
Administrator.

Part 60 of Chapter I, Title 40 of the Code of Federal Regulations is amended as follows:

1. Section 60.11 is amended by revising paragraph (b) as follows:

§ 60.11 Compliance with standards and maintenance requirements.

* * * * *

(b) Compliance with opacity standards in this part shall be determined by conducting observations in accordance with Reference Method 9 in Appendix A of this part or any alternative method that is approved by the Administrator. Opacity readings of portions of plumes which contain condensed, uncombined water vapor shall not be used for purposes of determining compliance with opacity standards. The results of continuous monitoring by transmissometer which indicate that the opacity at the time visual observations were made was not in excess of the standard are probative but not conclusive evidence of the actual opacity of an emission, provided that the source shall meet the burden of proving that the instrument used meets (at the time of the alleged violation) Performance Specification 1 in Appendix B of this part, has been properly maintained and (at the time of the alleged violation) calibrated, and that the resulting data have not been tampered with in any way.

* * * * *

(Secs. 111, 114, 301(a), Clean Air Act, Sec. 4(a) of Pub. L. 91-604, 84 Stat. 1683; sec. 4(a) of Pub. L. 91-604, 84 Stat. 1687; sec. 2 of Pub. L. No. 90-148 81 Stat. 504 (42 U.S.C. 1857c-6, 1857c-9, 1857g(a)).)

[FR Doc.77-14862 Filed 5-20-77;8:45 am]

61

Title 40—Protection of Environment

CHAPTER 1—ENVIRONMENTAL PROTECTION AGENCY

[FRL 749-8]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Petroleum Refinery Fluid Catalytic Cracking Unit Catalyst Regenerators

AGENCY: Environmental Protection Agency.

ACTION: Final rule.

SUMMARY: This rule revises the standard which limits the opacity of emissions from new, modified, or reconstructed petroleum refinery fluid catalytic cracking unit catalyst regenerators to 30 percent, except for one six-minute period in any one hour. The revision is being made to make the standard consistent with a revision to the test method for opacity. The standard implements the Clean Air Act and is intended to require the proper operation and maintenance of fluid catalytic cracking unit catalyst regenerators.

EFFECTIVE DATE: June 24, 1976.

ADDRESSES: Copies of the comment letters and a report which contains a summary of the issues and EPA's responses are available for public inspection and copying at the U.S. Environmental Protection Agency, Public Information Reference Unit (EPA Library), Room 2922, 401 M Street SW., Washington, D.C. Copies of the report also may be obtained upon written request from the EPA Public Information Center (PM-215), Washington, D.C. 20460 (specify Comment Summary—Petroleum Refinery Fluid Catalytic Cracking Units).

FOR FURTHER INFORMATION CONTACT:

Don R. Goodwin, Emission Standards and Engineering Division, Environmental Protection Agency, Research Triangle Park, North Carolina 27711, telephone number 919-688-8146, extension 271.

SUPPLEMENTARY INFORMATION:

BACKGROUND

On June 29, 1973, the U.S. Court of Appeals for the District of Columbia Circuit remanded to EPA the standards of performance for Portland cement plants (*Portland Cement Association v. Ruckelshaus*, 486 F. 2d 375). One of the issues remanded was the use of opacity standards. On November 12, 1974, EPA responded to the remand (39 FR 39872) and on May 22, 1975, the Court affirmed the use of opacity standards (513 F. 2d 506).

In the remand response, EPA reconsidered the use of opacity standards and concluded that they are a reliable, inexpensive, and useful means of ensuring that control equipment is properly maintained and operated at all times. EPA also made revisions to the general provisions of 40 CFR Part 60 and to the Reference Method 9.

EPA reevaluated the opacity standard for petroleum refinery fluid catalytic cracking unit catalyst regenerators in light of the revisions to Reference Method 9, and proposed a revision to this standard on August 30, 1976 (41 FR 36600). The revision is not the result of a reevaluation of the technical, economic and environmental basis for the standard. Consequently, the revised opacity standard will be neither more nor less stringent than the previous standard, and will be consistent with the mass emission standard (1.0 kg/1000 kg of coke burnoff).

SUMMARY OF COMMENTS AND EPA'S RESPONSES

EPA received six letters commenting on the proposed revision (three from industry and three from State and local governments). Two commenters pointed out that the basis for the original opacity standard assumed new fluid catalytic cracking units would be of 65,000 barrels per day capacity, but the proposed revision assumed new fluid catalytic cracking units would be of less than 50,000 barrels per day capacity. Two other commenters pointed out that the original standard allowed one three-minute exception from the opacity standard of performance to accommodate sootblowing in the carbon monoxide boiler and that the proposed change to six-minute averages did not justify adding an additional exception.

A review of the basis for the original opacity standard indicates the commenters are correct. Large, new or modified fluid catalytic cracking units will more likely be in the range of 65,000 barrels per day capacity, and one exception per hour more accurately reflects the one three-minute exception allowed under the previous test method. The effect of increased capacity on the opacity of particulate mass emissions was discussed both in the FEDERAL REGISTER notice proposing revision of the opacity standard and in the background information document supporting the revision. Considering the effect on opacity of the greater capacity of a 65,000-barrel-per-day fluid catalytic cracking unit compared to a 50,000-barrel-per-day unit leads to the conclusion that the opacity standard should not be revised to 25 percent, but should remain at 30 percent opacity. Accordingly, the revised opacity standard is promulgated as 30 percent opacity with one six-minute exception period per hour.

One comment concerned § 60.11(e) of the General Provisions and questioned whether in its present form it adequately accounts for the problems of petroleum refinery fluid catalytic cracking units. Section 60.11(e) provides relief for those individual sources where, because of operating variables, opacity readings are abnormally high and cause it to exceed the standard, even though it is in compliance with the mass emission standard. The mechanism for relief is that opacity readings may be taken during initial start-up mass emission testing and a special opacity standard assigned to the source.

Petroleum refinery fluid catalytic cracking units operate continuously for periods of two years or more; and over such long periods, mass and opacity emissions gradually increase. For this reason, the mass and opacity standards were set on the basis of levels achievable at the end of the run. It is to be expected, therefore, that at the beginning of the run, both mass and opacity emissions from such units will be well below the standard, even in some cases where opacity readings are abnormally high given the mass emissions. In such cases, an individualized opacity standard based on beginning-of-run readings would not necessarily prevent the facility which still meets the mass emissions standard at the end of the run from failing an end-of-run opacity test. To alleviate this problem, EPA is adding a new § 60.106 (e) to the petroleum refinery standard which, in conjunction with §§ 60.11 (e) (2), (e)(3), and (e)(4) of the General Provisions, will permit determination of an individualized opacity standard for a fluid catalytic cracking unit during any performance test and not just the initial performance test. This will ensure that a properly operated and maintained source will not be found in violation of the opacity standard, while in compliance with the applicable mass emission standard.

The proposed amendment to § 60.102 (a)(2) specified that opacity readings of portions of plumes which contain condensed, uncombined water vapor are not to be used for determining compliance with opacity standards. Since this provision has been added to § 60.11(b) of the General Provisions, it is not necessary to repeat it in Subpart J for petroleum refineries.

MISCELLANEOUS

The opacity standard, as modified, applies to all affected facilities for which construction or modification was commenced after June 11, 1973, the date the standard was proposed.

This revision is promulgated under the authority of sections 111, 114, and 301(a) of the Clean Air Act, as amended by Public Law 91-604, 84 Statute 1683, 1687 (42 U.S.C. 1857c-6, 1857c-9) and Public Law 90-148, 81 Statute 504 (42 U.S.C. 1857g(a)).

NOTE.—The Environmental Protection Agency has determined that this document does not contain a major proposal requiring preparation of an Economic Impact Statement under Executive Orders 11821 and 11949, and OMB Circular A-107.

Dated: June 20, 1977. 65

DOUGLAS M. COSTLE,
Administrator.

Part 60, Chapter I of Title 40 of the Code of Federal Regulations is amended as follows:

1. Section 60.102(a)(2) is revised to read as follows:

§ 60.102 Standard for particulate matter.

(a) * * *

(2) Gases exhibiting greater than 30 percent opacity, except for one six-minute average opacity reading in any one hour.

* * * * *

(Sec. 111, Pub. L. 91-604, 84 Stat. 1683 (42 U.S.C. 1857c-6); sec. 301(a), Pub. L. 90-148, 81 Stat. 504 (42 U.S.C. 1857g(a)).)

2. Section 60.105(e)(1) is revised to read as follows:

§ 60.105 Emission monitoring.

* * * * *

(e) * * *

(1) Opacity. All hourly periods which contain two or more six-minute periods during which the average opacity as measured by the continuous monitoring system exceeds 30 percent.

* * * * *

3. Section 60.106(e) is added to read as follows:

§ 60.106 Test methods and procedures.

* * * * *

(e) An owner or operator of an affected facility may request the Administrator to determine opacity of emissions from the affected facility during any performance test covered under § 60.8. In such event the provisions of §§ 60.11 (e) (2), (e)(3), and (e)(4) shall apply.

(Sec. 111, 114, Pub. L. 91-604, 84 Stat. 1683, 1687 (42 U.S.C. 1857c-6, 1857c-9); sec. 301(a), Pub. L. 90-148, 81 Stat. 504 (42 U.S.C. 1857g (a)).)

[FR Doc.77-18159 Filed 6-23-77;8:45 am]

[FRL 752-3]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Units and Abbreviations

AGENCY: Environmental Protection Agency

ACTION: Final rule

SUMMARY: This action revises the General Provisions by reorganizing the units and abbreviations and adding the International System of Units (SI). Until recently, EPA did not have a preferred system of measurement to be used in its regulations. Now the Agency is using SI units in all regulations issued under this part. This necessitates that SI units be added to the General Provisions to provide a complete listing of abbreviations used.

EFFECTIVE DATE: August 18, 1977.

FOR FURTHER INFORMATION CONTACT:

Don R. Goodwin, Emission Standards and Engineering Division, Environmental Protection Agency, Research Triangle Park, North Carolina 27711, telephone no. 919-541-5271.

SUPPLEMENTARY INFORMATION:

BACKGROUND

Section 3 of Pub. L. 94-168, the Metric Conversion Act of 1975, declares that the policy of the United States shall be to coordinate and plan the increasing use of the metric system in the United States. On December 10, 1976, a notice was published in the FEDERAL REGISTER (41 FR 54018) that set forth the interpretation and modification of the International System of Units (SI) for the United States. EPA incorporates SI units in all regulations issued under 40 CFR Part 60 and provides common equivalents in parentheses where desirable. Use of SI units requires this revision of the abbreviations section (§ 60.3) of the General Provisions of 40 CFR Part 60.

REFERENCE DOCUMENTS

An explanation of the International Systems of Units was presented in the FEDERAL REGISTER notice mentioned above (41 FR 54018). The Environmental Protection Agency is using the Standard for Metric Practice (E 380-76) published by the American Society for Testing and Materials (A.S.T.M.) as its basic reference. This document may be obtained by sending $4.00 to A.S.T.M., 1916 Race Street, Philadelphia, Pennsylvania 19103.

MISCELLANEOUS

As this revision has no regulatory impact, but only defines units and abbreviations used in this part, opportunity for public participation was judged unnecessary.

(Sections 111 and 301(a) of the Clean Air Act; sec. 4(a) of Pub. L. 91-604, 84 Stat. 1683; sec. 2 of Pub. L. 90-148, 81 Stat. 504 (42 U.S.C. 1857c-6, 1857g(a)).)

NOTE.—The Environmental Protection Agency has determined that this document does not contain a major proposal requiring preparation of an Economic Impact Analysis under Executive Orders 11821 and 11949 and OMB Circular A-107.

Dated: July 8, 1977.

DOUGLAS M. COSTLE,
Administrator.

40 CFR Part 60 is amended by revising § 60.3 to read as follows:

§ 60.3 Units and abbreviations.

Used in this part are abbreviations and symbols of units of measure. These are defined as follows:

(a) System International (SI) units of measure:

A—ampere
g—gram
Hz—hertz
J—joule
K—degree Kelvin
kg—kilogram
m—meter
m^3—cubic meter
mg—milligram—10^{-3} gram
mm—millimeter—10^{-3} meter
Mg—megagram—10^{6} gram
mol—mole
N—newton
ng—nanogram—10^{-9} gram
nm—nanometer—10^{-9} meter
Pa—pascal
s—second
V—volt
W—watt
Ω—ohm
μg—microgram—10^{-6} gram

(b) Other units of measure:

Btu—British thermal unit
°C—degree Celsius (centigrade)
cal—calorie
cfm—cubic feet per minute
cu ft—cubic feet
dcf—dry cubic feet
dcm—dry cubic meter
dscf—dry cubic feet at standard conditions
dscm—dry cubic meter at standard conditions
eq—equivalent
°F—degree Fahrenheit
ft—feet
gal—gallon
gr—grain
g-eq—gram equivalent
hr—hour
in—inch
k—1,000
l—liter
lpm—liter per minute
lb—pound
meq—milliequivalent
min—minute
ml—milliliter
mol. wt.—molecular weight
ppb—parts per billion
ppm—parts per million
psia—pounds per square inch absolute
psig—pounds per square inch gage
°R—degree Rankine
scf—cubic feet at standard conditions
scfh—cubic feet per hour at standard conditions
scm—cubic meter at standard conditions
sec—second
sq ft—square feet
std—at standard conditions

(c) Chemical nomenclature:

CdS—cadmium sulfide
CO—carbon monoxide
CO_2—carbon dioxide
HCl—hydrochloric acid
Hg—mercury
H_2O—water
H_2S—hydrogen sulfide
H_2SO_4—sulfuric acid
N_2—nitrogen
NO—nitric oxide
NO_2—nitrogen dioxide
NO_x—nitrogen oxides
O_2—oxygen
SO_2—sulfur dioxide
SO_3—sulfur trioxide
SO_x—sulfur oxides

(d) Miscellaneous:

A.S.T.M.—American Society for Testing and Materials

(Sections 111 and 301(a) of the Clean Air Act; sec. 4(a) of Pub. L. 91-604, 84 Stat. 1683; sec. 2 of Pub. L. 90-148, 81 Stat. 504 (42 U.S.C. 1857c-6, 1857g(a)).)

[FR Doc.77-[illegible] Filed 7-18-77;8:45 am]

63

[FRL 769-8]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Delegation of Authority to the State of New Jersey

AGENCY: Environmental Protection Agency.

ACTION: Final Rule.

SUMMARY: A notice announcing EPA's delegation of authority for the New Source Performance Standards to the State of New Jersey is published at page 37387 of today's FEDERAL REGISTER. In order to reflect this delegation, this document amends EPA regulations to require the submission of all notices, reports, and other communications called for by the delegated regulations to the State of New Jersey rather than to EPA.

EFFECTIVE DATE: July 21, 1977.

FOR FURTHER INFORMATION CONTACT:

J. Kevin Healy, Attorney, U.S. Environmental Protection Agency, Region II, General Enforcement Branch, Enforcement Division, 26 Federal Plaza, New York, New York 10007, 212-264-1196).

SUPPLEMENTARY INFORMATION: On May 9, 1977 EPA delegated authority to the State of New Jersey to implement and enforce the New Source Performance Standards. A full account of the background to this action and of the exact terms of the delegation appear in the Notice of Delegation which is also published in today's FEDERAL REGISTER.

This rulemaking is effective immediately, since the Administrator has found good cause to forego prior public notice. This addition of the State of New Jersey address to the Code of Federal Regulations is a technical change and imposes no additional substantive burden on the parties affected.

Dated: July 18, 1977.

BARBARA BLUM,
Acting Administrator.

Part 60 of Chapter I, Title 40 of the Code of Federal Regulations is amended under authority of Section 111 of the Clean Air Act (42 U.S.C. 1857c-6), as follows:

(1) In § 60.4 paragraph (b) is amended by revising subparagraph (FF) to read as follows:

§ 60.4 Address.

* * * * *

(b) * * *

(FF)—State of New Jersey: New Jersey Department of Environmental Protection, John Fitch Plaza, P.O. Box 2807, Trenton, New Jersey 08625.

* * * * *

[FR Doc.77-21020 Filed 7-20-77;8:45 am]

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PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Applicability Dates

AGENCY: Environmental Protection Agency.

ACTION: Final rule.

SUMMARY: This action incorporates into the regulations the dates on which the standards of performance are applicable. The dates were not a part of the regulations at the time of their promulgation and considerable confusion exists over when the standards apply. This action removes the confusion and makes future enforcement of the standards easier.

EFFECTIVE DATE: August 24, 1977.

FOR FURTHER INFORMATION CONTACT:

Don. R. Goodwin, Emission Standards and Engineering Division, Environmental Protection Agency, Research Triangle Park, North Carolina 27711, telephone 919-541-5271.

SUPPLEMENTARY INFORMATION: Section 111 of the Clean Air Act provides that "new source" under that section means "any stationary source, the construction or modification of which is commenced after the publication of regulations (or, if earlier, proposed regulations) prescribing a standard of performance which will be applicable to such source." Thus, for standards of performance under section 111, the proposal date (or, in the event there was no proposal, the promulgation date) of a standard constitutes its applicability date. While this information is contained in the "Applicability" section (§ 60.2) of the General Provisions, the Agency has not, until now, incorporated in the regulations the specific applicability date(s) for each standard.

The absence of these dates from the various regulations has led to some confusion. The most frequent mistake is for the applicability date to be confused with the effective date. The effective date is the day on which the regulation becomes law (usually the day the final regulation is published in the FEDERAL REGISTER). The effective date has customarily been noted in the preamble to the final regulation when it appears in the FEDERAL REGISTER. A regulation, then, usually becomes effective upon promulgation and applies to sources constructed or modified after the proposal date.

In view of past confusion and the growing number of regulations, including revisions and amendments, the Agency has decided to hereafter incorporate the applicability date(s) under the "Applicability and designation of affected facility" section of each subpart. This action should serve to clarify which facilities are affected by these regulations. This amendment provides clarification of the applicability dates only for the standards promulgated to date. An applicability statement will be added to regulations under proposal and to future regulations at the time of promulgation.

MISCELLANEOUS

As this action has no regulatory impact, but only sets forth applicability dates for the purpose of clarification, public participation was judged unnecessary.

(Secs. 111 and 301(a) of the Clean Air Act; sec. 4(a) of Pub. L. 91-604, 84 Stat. 1683; sec. 2 of Pub. L. 90-148, 81 Stat. 504 (42 U.S.C. 1857c-6, 1857g(a)).)

NOTE.—The Environmental Protection Agency has determined that this document does not contain a major proposal requiring preparation of an Economic Impact Analysis under Executive Orders 11821 and 11949 and OMB Circular A-107.

Dated: July 18, 1977.

BARBARA BLUM,
Acting Administrator.

40 CFR Part 60 is amended by revising Subparts D through AA as follows:

Subpart D—Standards of Performance for Fossil-Fuel-Fired Steam Generators

1. Section 60.40 is revised as follows:

§ 60.40 Applicability and designation of affected facility.

(a) The affected facilities to which the provisions of this subpart apply are:

(1) Each fossil-fuel-fired steam generating unit of more than 73 megawatts heat input rate (250 million Btu per hour).

(2) Each fossil-fuel and wood-residue-fired steam generating unit capable of firing fossil fuel at a heat input rate of more than 73 megawatts (250 million Btu per hour).

(b) Any change to an existing fossil-fuel-fired steam generating unit to accommodate the use of combustible materials, other than fossil fuels as defined in this subpart, shall not bring that unit under the applicability of this subpart.

(c) Any facility under paragraph (a) of this section that commences construction or modification after August 17, 1971, is subject to the requirements of this subpart.

Subpart E—Standards of Performance for Incinerators

2. Section 60.50 is revised as follows:

§ 60.50 Applicability and designation of affected facility.

(a) The provisions of this subpart are applicable to each incinerator of more than 45 metric tons per day charging rate (50 tons/day), which is the affected facility.

(b) Any facility under paragraph (a) of this section that commences construction or modification after August 17, 1971, is subject to the requirements of this subpart.

Subpart F—Standards of Performance for Portland Cement Plants

3. Section 60.60 is revised as follows:

§ 60.60 Applicability and designation of affected facility.

(a) The provisions of this subpart are applicable to the following affected facilities in portland cement plants: kiln, clinker cooler, raw mill system, finish mill system, raw mill dryer, raw material storage, clinker storage, finished product storage, conveyor transfer points, bagging and bulk loading and unloading systems.

(b) Any facility under paragraph (a) of this section that commences construction or modification after August 17, 1971, is subject to the requirements of this subpart.

Subpart G—Standards of Performance for Nitric Acid Plants

4. Section 60.70 is revised as follows:

§ 60.70 Applicability and designation of affected facility.

(a) The provisions of this subpart are applicable to each nitric acid production unit, which is the affected facility.

(b) Any facility under paragraph (a) of this section that commences construction or modification after August 17, 1971, is subject to the requirements of this subpart.

Subpart H—Standards of Performance for Sulfuric Acid Plants

5. Section 60.80 is revised as follows:

§ 60.80 Applicability and designation of affected facility.

(a) The provisions of this subpart are applicable to each sulfuric acid production unit, which is the affected facility.

(b) Any facility under paragraph (a) of this section that commences construction or modification after August 17, 1971, is subject to the requirements of this subpart.

Subpart I—Standards of Performance for Asphalt Concrete Plants

6. Section 60.90 is revised as follows:

§ 60.90 Applicability and designation of affected facility.

(a) The affected facility to which the provisions of this subpart apply is each asphalt concrete plant. For the purpose of this subpart, an asphalt concrete plant is comprised only of any combination of the following: dryers; systems for screening, handling, storing, and weighing hot aggregate; systems for loading, transferring, and storing mineral filler; systems for mixing asphalt concrete; and the loading, transfer, and storage systems associated with emission control systems.

Subpart J—Standards of Performance for Petroleum Refineries

7. Section 60.100 is revised as follows:

§ 60.100 Applicability and designation of affected facility.

(a) The provisions of this subpart are applicable to the following affected facilities in petroleum refineries: fluid catalytic cracking unit catalyst regenerators, fluid catalytic cracking unit incinerator-waste heat boilers, and fuel gas combustion devices.

(b) Any facility under paragraph (a) of this section that commences construction or modification after June 11, 1973, is subject to the requirements of this subpart.

Subpart K—Standards of Performance for Storage Vessels for Petroleum Liquids

8. Section 60.110 is revised as follows:

§ 60.110 Applicability and designation of affected facility.

(a) Except as provided in § 60.110(b), the affected facility to which this subpart applies is each storage vessel for petroleum liquids which has a storage capacity greater than 151,412 liters (40,000 gallons).

(b) This subpart does not apply to storage vessels for petroleum or condensate stored, processed, and/or treated at a drilling and production facility prior to custody transfer.

(c) Subject to the requirements of this subpart is any facility under paragraph (a) of this section which:

(1) Has a capacity greater than 151,412 liters (40,000 gallons), but not exceeding 245,000 liters (65,000 gallons), and commences construction or modification after March 8, 1974.

(2) Has a capacity greater than 245,000 liter (65,000 gallons), and commences construction or modification after June 11, 1973.

Subpart L—Standards of Performance for Secondary Lead Smelters

9. Section 60.120 is revised as follows:

§ 60.120 Applicability and designation of affected facility.

(a) The provisions of this subpart are applicable to the following affected facilities in secondary lead smelters: pot furnaces of more than 250 kg (550 lb) charging capacity, blast (cupola) furnaces, and reverberatory furnaces.

(b) Any facility under paragraph (a) of this section that commences construction or modification after June 11, 1973, is subject to the requirements of this subpart.

Subpart M—Standards of Performance for Secondary Brass and Bronze Ingot Production Plants

10. Section 60.130 is revised as follows:

§ 60.130 Applicability and designation of affected facility.

(a) The provisions of this subpart are applicable to the following affected facilities in secondary brass or bronze ingot production plants: reverberatory and electric furnaces of 1,000 kg (2,205 lb) or greater production capacity and blast (cupola) furnaces of 250 kg/hr (550 lb/hr) or greater production capacity.

(b) Any facility under paragraph (a) of this section that commences construction or modification after June 11, 1973, is subject to the requirements of this subpart.

Subpart N—Standards of Performance for Iron and Steel Plants

11. Section 60.140 is revised as follows:

§ 60.140 Applicability and designation of affected facility.

(a) The affected facility to which the provisions of this subpart apply is each basic oxygen process furnace.

(b) Any facility under paragraph (a) of this section that commences construction or modification after June 11, 1973, is subject to the requirements of this subpart.

Subpart O—Standards of Performance for Sewage Treatment Plants

12. Section 60.150 is revised as follows:

§ 60.150 Applicability and designation of affected facility.

(a) The affected facility to which the provisions of this subpart apply is each incinerator which burns the sludge produced by municipal sewage treatment facilities.

(b) Any facility under paragraph (a) of this section that commences construction or modification after June 11, 1973, is subject to the requirements of this subpart.

Subpart P—Standards of Performance for Primary Copper Smelters

13. Section 60.160 is revised as follows:

§ 60.160 Applicability and designation of affected facility.

(a) The provisions of this subpart are applicable to the following affected facilities in primary copper smelters: dryer, roaster, smelting furnace, and copper converter.

(b) Any facility under paragraph (a) of this section that commences construction or modification after October 16, 1974, is subject to the requirements of this subpart.

Subpart Q—Standards of Performance for Primary Zinc Smelters

14. Section 60.170 is revised as follows:

§ 60.170 Applicability and designation of affected facility.

(a) The provisions of this subpart are applicable to the following affected facilities in primary zinc smelters: roaster and sintering machine.

(b) Any facility under paragraph (a) of this section that commences construction or modification after October 16, 1974, is subject to the requirements of this subpart.

Subpart R—Standards of Performance for Primary Lead Smelters

15. Section 60.180 is revised as follows:

§ 60.180 Applicability and designation of affected facility.

(a) The provisions of this subpart are applicable to the following affected facilities in primary lead smelters: sintering machine, sintering machine discharge end, blast furnace, dross reverberatory furnace, electric smelting furnace, and converter.

(b) Any facility under paragraph (a) of this section that commences construction or modification after October 16, 1974, is subject to the requirements of this subpart.

Subpart S—Standards of Performance for Primary Aluminum Reduction Plants

16. Section 60.190 is revised as follows:

§ 60.190 Applicability and designation of affected facility.

(a) The affected facilities in primary aluminum reduction plants to which this subpart applies are potroom groups and anode bake plants.

(b) Any facility under paragraph (a) of this section that commences construction or modification after October 23, 1974, is subject to the requirements of this subpart.

Subpart T—Standards of Performance for the Phosphate Fertilizer Industry: Wet-Process Phosphoric Acid Plants

17. Section 60.200 is revised as follows:

§ 60.200 Applicability and designation of affected facility.

(a) The affected facility to which the provisions of this subpart apply is each wet-process phosphoric acid plant. For the purpose of this subpart, the affected facility includes any combination of: reactors, filters, evaporators, and hotwells.

(b) Any facility under paragraph (a) of this section that commences construction or modification after October 22, 1974, is subject to the requirements of this subpart.

Subpart U—Standards of Performance for the Phosphate Fertilizer Industry: Superphosphoric Acid Plants

18. Section 60.210 is revised as follows:

§ 60.210 Applicability and designation of affected facility..

(a) The affected facility to which the provisions of this subpart apply is each superphosphoric acid plant. For the purpose of this subpart, the affected facility includes any combination of: evaporators, hotwells, acid sumps, and cooling tanks.

(b) Any facility under paragraph (a) of this section that commences construction or modification after October 22, 1974, is subject to the requirements of this subpart.

Subpart V—Standards of Performance for the Phosphate Fertilizer Industry: Diammonium Phosphate Plants

19. Section 60.220 is revised as follows:

§ 60.220 Applicability and designation of affected facility.

(a) The affected facility to which the provisions of this subpart apply is each granular diammonium phosphate plant. For the purpose of this subpart, the affected facility includes any combination of: reactors, granulators, dryers, coolers, screens, and mills.

(b) Any facility under paragraph (a) of this section that commences construction or modification after October 22, 1974, is subject to the requirements of this subpart.

Subpart W—Standards of Performance for the Phosphate Fertilizer Industry: Triple Superphosphate Plants

20. Section 60.230 is revised as follows:

§ 60.230 Applicability and designation of affected facility.

(a) The affected facility to which the provisions of this subpart apply is each triple superphosphate plant. For the purpose of this subpart, the affected facility includes any combination of: mixers, curing belts (dens), reactors, granulators, dryers, cookers, screens, mills, and facilities which store run-of-pile triple superphosphate.

(b) Any facility under paragraph (a) of this section that commences construction or modification after October 22, 1974, is subject to the requirements of this subpart.

Subpart X—Standards of Performance for the Phosphate Fertilizer Industry: Granular Triple Superphosphate Storage Facilities

21. Section 60.240 is revised as follows:

§ 60.240 Applicability and designation of affected facility.

(a) The affected facility to which the provisions of this subpart apply is each granular triple superphosphate storage facility. For the purpose of this subpart, the affected facility includes any combination of: storage or curing piles, conveyors, elevators, screens, and mills.

(b) Any facility under paragraph (a) of this section that commences construction or modification after October 22, 1974, is subject to the requirements of this subpart.

Subpart Y—Standards of Performance for Coal Preparation Plants

22. Section 60.250 is revised as follows:

§ 60.250 Applicability and designation of affected facility.

(a) The provisions of this subpart are applicable to any of the following affected facilities in coal preparation plants which process more than 200 tons per day: thermal dryers, pneumatic coal-cleaning equipment (air tables), coal processing and conveying equipment (including breakers and crushers), coal storage systems, and coal transfer and loading systems.

(b) Any facility under paragraph (a) of this section that commences construction or modification after October 21, 1974, is subject to the requirements of this subpart.

Subpart Z—Standards of Performance for Ferroalloy Production Facilities

23. Section 60.260 is revised as follows:

§ 60.260 Applicability and designation of affected facility.

(a) The provisions of this subpart are applicable to the following affected facilities: electric submerged arc furnaces which produce silicon metal, ferrosilicon, calcium silicon, silicomanganese zirconium, ferrochrome silicon, silvery iron, high-carbon ferrochrome, charge chrome, standard ferromanganese, silicomanganese, ferromanganese silicon, or calcium carbide; and dust-handling equipment.

(b) Any facility under paragraph (a) of this section that commences construction or modification after October 21, 1974, is subject to the requirements of this subpart.

Subpart AA—Standards of Performance for Steel Plants: Electric Arc Furnaces

24. Section 60.270 is revised as follows:

§ 60.270 Applicability and designation of affected facility.

(a) The provisions of this subpart are applicable to the following affected facilities in steel plants: electric arc furnaces and dust-handling equipment.

(b) Any facility under paragraph (a) of this section that commences construction or modification after October 24, 1974, is subject to the requirements of this subpart.

(Secs. 111 and 301(a), Clean Air Act as amended (42 U.S.C. 1857c-6, 1857g(a)).)

[FR Doc.77-21[illegible] Filed 7-22-77;8:45 am]

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Title 40—Protection of the Environment

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

[FRL 742-5]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Petroleum Refinery Fluid Catalytic Cracking Unit Catalyst Regenerators

Correction

In FR Doc. 77-18129, appearing at page 32426, in Part VI of the issue of Friday, June 24, 1977, the EFFECTIVE DATE should be changed to read "June 24, 1977".

[FRL-753-2]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Units and Abbreviations

Correction

In FR Doc. 77-20557, appearing on page 37000 in the issue for Tuesday, July 19, 1977, in the second column, § 60.3(a) should be changed so that the last abbreviation reads as follows:

"μg—microgram—10^{-6} gram".

FEDERAL REGISTER, VOL. 42,

NO. 144—WEDNESDAY, JULY 27, 1977

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PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Petroleum Refinery Fluid Catalytic Cracking Unit Catalyst Regenerators; Correction

AGENCY: Environmental Protection Agency.

ACTION: Correction.

SUMMARY: This document corrects the final rule that appeared at page 32425 in the FEDERAL REGISTER of Friday, June 24, 1977 (FR Doc. 77-18129).

EFFECTIVE DATE: August 4, 1977.

FOR FURTHER INFORMATION CONTACT:

Don R. Goodwin, Emission Standards and Engineering Division, Environmental Protection Agency, Research Triangle Park, North Carolina 27711, telephone 919-541-5271.

Dated: July 29, 1977.

ERIC O. STORK,
Acting Assistant Administrator for Air and Waste Management.

In FR Doc. 77-18129 appearing on page 32425 in the FEDERAL REGISTER of Friday, June 24, 1977, §§ 60.102(a)(2) and 60.105(e)(1) on page 32427 are corrected as follows:

1. In § 60.102(a)(2), the word "period" is added in the fourth line immediately following the words "in any one-hour."

2. In § 60.105(e)(1), "hourly period" in the first line is corrected to read "one-hour periods."

(Sec. 111, 114, 301(a) of the Clean Air Act as amended [42 U.S.C. 1857c-6, 1857c-9, 1857g(a)]).

[FR Doc.77-22357 Filed 8-3-77;8:45 am]

FEDERAL REGISTER, VOL. 42,

NO. 150—THURSDAY, AUGUST 4, 1977

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PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Amendments to Subpart D; Correction

AGENCY: Environmental Protection Agency.

ACTION: Correction.

SUMMARY: This document corrects the final rule that appeared at page 51397 in the FEDERAL REGISTER of Monday, November 22, 1976 (FR Doc. 76-33966).

EFFECTIVE DATE: August 15, 1977.

FOR FURTHER INFORMATION CONTACT:

Don R. Goodwin, Emission Standards and Engineering Division, Environmental Protection Agency, Research Triangle Park, N.C. 27711, Telephone No. 919-541-5271.

Dated August 8, 1977.

EDWARD F. TUERK,
Acting Assistant Administrator, for Air and Waste Management.

In FR Doc. 76-33966, §§ 60.45(f)(4) and 60.45(f)(5) on page 51399 are corrected as follows:

§ 60.45 [Amended]

1. In § 60.45(f)(4)(iii) "F_c=0.384 scm CO_2/J" in the fourth line is corrected to read "F_c=0.384×10^{-7} scm CO_2/J."

2. In § 60.45(f)(4)(iv) a left parenthesis is inserted in the second line between "dscm/J" and "8,740."

3. § 60.45(f)(4)(v) is corrected to read as follows:

§ 60.45 Emission and fuel monitoring.

* * * * *

(f) * * *

(4) * * *

(v) For bark $F=2.589\times10^{-7}$ dscm/J (9,640 dscf/million Btu) and $F_c=0.500\times10^{-7}$ scm CO_2/J (1,860 scf CO_2/million Btu). For wood residue other than bark $F=2.492\times10^{-7}$ dscm/J (9,280 dscf/million Btu) and $F_c=0.494\times10^{-7}$ scm CO_2/J (1,840 scf CO_2/million Btu).

* * * * *

4. In § 60.45(f)(5) the F factor and F_c factor equations in SI units are corrected to read as follows:

$$F=10^{-6}\frac{[227.2\ (\text{pct. H})+95.5\ (\text{pct. C})+35.6\ (\text{pct. S})+8.7\ (\text{pct. N})-28.7\ (\text{pct. O})]}{\text{GCV}}.$$

$$F_c=\frac{2.0\times10^{-5}\ (\text{pct. C})}{\text{GCV}}.$$

(Sec. 111, 114, 301(a) of the Clean Air Act as amended (42 U.S.C. 1857c-6, 1857c-9, 1857g(a)).)

[FR Doc.77-23403 Filed 8-12-77;8:45 am]

FEDERAL REGISTER, VOL. 42,

NO. 157—MONDAY, AUGUST 15, 1977

Title 40—Protection of Environment

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

[FRL 775-4]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

PART 61—NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS

Authority Citations; Revision

AGENCY: Environmental Protection Agency.

ACTION: Final rule.

SUMMARY: This action revises the authority citations for Standards of Performance for New Stationary Sources and National Emission Standards for Hazardous Air Pollutants. The revision adopts a method recommended by the FEDERAL REGISTER for identifying which sections are enacted under which statutory authority, making the citations more useful to the reader.

EFFECTIVE DATE: August 17, 1977.

FOR FURTHER INFORMATION CONTACT:

Don R. Goodwin, Emission Standards and Engineering Division, Environmental Protection Agency, Research Triangle Park, N.C. 27711, telephone 919-541-5271.

SUPPLEMENTARY INFORMATION: This action is being taken in accordance with the requirements of 1 CFR 21.43 and is authorized under section 301(a) of the Clean Air Act, as amended, 42 U.S.C. 1857g(a). Because the amendments are clerical in nature and affect no substantive rights or requirements, the Administrator finds it unnecessary to propose and invite public comment.

Dated: August 12, 1977.

DOUGLAS M. COSTLE,
Administrator.

Parts 60 and 61 of Chapter I, Title 40 of the Code of Federal Regulations are revised as follows:

1. The authority citation following the table of sections in Part 60 is revised to read as follows:

AUTHORITY: Sec. 111, 301(a) of the Clean Air Act as amended (42 U.S.C. 1857c-6, 1857g (a)), unless otherwise noted.

2. Following §§ 60.10 and 60.24(g) the following authority citation is added:

(Sec. 116 of the Clean Air Act as amended (42 U.S.C. 1857d-1).)

3. Following §§ 60.7, 60.8, 60.9, 60.11, 60.13, 60.45, 60.46, 60.53, 60.54, 60.63, 60.64, 60.73, 60.74, 60.84, 60.85, 60.93, 60.105, 60.106, 60.113, 60.123, 60.133, 60.144, 60.153, 60.154, 60.165, 60.166, 60.175, 60.176, 60.185, 60.186, 60.194, 60.195, 60.203, 60.204, 60.213, 60.214, 60.223, 60.224, 60.233, 60.234, 60.243, 60.244, 60.253, 60.254, 60.264, 60.265, 60.266, 60.273, 60.274, 60.275 and Appendices A, B, C, and D, the following authority citation is added:

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).).

4. The authority citation following the table of sections in Part 61 is revised to read as follows:

AUTHORITY: Sec. 112, 301(a) of the Clean Air Act as amended (42 U.S.C. 1857c-7, 1857g (a)), unless otherwise noted.

5. Following § 61.16, the following authority citation is added:

(Sec. 116 of the Clean Air Act as amended (42 U.S.C. 1857d-1).)

6. Following §§ 61.09, 61.10, 61.12, 61.13, 61.14, 61.15, 61.24, 61.33, 61.34, 61.43, 61.44, 61.53, 61.54, 61.55, 61.67, 61.68, 61.69, 61.70, 61.71, and Appendices A and B, the following authority citation is added:

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 1857c-9).)

[FR Doc.77-23837 Filed 8-16-77;8:45 am]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Revision to Reference Methods 1–8

AGENCY: Environmental Protection Agency.

ACTION: Final Rule.

SUMMARY: This rule revises Reference Methods 1 through 8, the detailed requirements used to measure emissions from affected facilities to determine whether they are in compliance with a standard of performance. The methods were originally promulgated December 23, 1971, and since that time several revisions became apparent which would clarify, correct and improve the methods. These revisions make the methods easier to use, and improve their accuracy and reliability.

EFFECTIVE DATE: September 19, 1977.

ADDRESSES: Copies of the comment letters are available for public inspection and copying at the U.S. Environmental Protection Agency, Public Information Reference Unit (EPA Library), Room 2922, 401 M Street, S.W., Washington, D.C. 20460. A summary of the comments and EPA's responses may be obtained upon written request from the EPA Public Information Center (PM-215), 401 M Street, S.W., Washington, D.C. 20460 (specify "Public Comment Summary: Revisions to Reference Methods 1–8 in Appendix A of Standards of Performance for New Stationary Sources").

FOR FURTHER INFORMATION CONTACT:

Don R. Goodwin, Emission Standards and Engineering Division, Environmental Protection Agency, Research Triangle Park, North Carolina 27711, telephone No. 919–541–5271.

SUPPLEMENTARY INFORMATION: The amendments were proposed on June 8, 1976 (40 FR 23060). A total of 55 comment letters were received during the comment period—34 from industry, 15 from governmental agencies, and 6 from other interested parties. They contained numerous suggestions which were incorporated in the final revisions.

Changes common to all eight of the reference methods are: (1) the clarification of procedures and equipment specifications resulting from the comments, (2) the addition of guidelines for alternative procedures and equipment to make prior approval of the Administrator unnecessary and (3) the addition of an introduction to each reference method discussing the general use of the method and delineating the procedure for using alternative methods and equipment.

Specific changes to the methods are:

METHOD 1

1. The provision for the use of more than two traverse diameters, when specified by the Administrator, has been deleted. If one traverse diameter is in a plane containing the greatest expected concentration variation, the intended purpose of the deleted paragraph will be fulfilled.

2. Based on recent data from Fluidyne (Particulate Sampling Strategies for Large Power Plants Including Nonuniform Flow, EPA-600/2-76-170, June 1976) and Entropy Environmentalists (Determination of the Optimum Number of Traverse Points: An Analysis of Method 1 Criteria (draft), Contract No. 68-01-3172), the number of traverse points for velocity measurements has been reduced and the 2:1 length to width ratio requirement for cross-sectional layout of rectangular ducts has been replaced by a "balanced matrix" scheme.

3. Guidelines for sampling in stacks containing cyclonic flow and stacks smaller than about 0.31 meter in diameter or 0.071 m² in cross-sectional area will be published at a later date.

4. Clarification has been made as to when a check for cyclonic flow is necessary; also, the suggested procedure for determination of unacceptable flow conditions has been revised.

METHOD 2

1. The calibration of certain pitot tubes has been made optional. Appropriate construction and application guidelines have been included.

2. A detailed calibration procedure for temperature gauges has been included.

3. A leak check procedure for pitot lines has been included.

METHOD 3

1. The applicability of the method has been confined to fossil-fuel combustion processes and to other processes where it has been determined that components other than O_2, CO_2, CO, and N_2 are not present in concentrations sufficient to affect the final results.

2. Based on recent research information (Particulate Sampling Strategies for Large Power Plants Including Nonuniform Flow, EPA-600/2-76-170, June 1976), the requirement for proportional sampling has been dropped and replaced with the requirement for constant rate sampling. Proportional and constant rate sampling have been found to give essentially the same result.

3. The "three consecutive" requirement has been replaced by "any three" for the determination of molecular weight, CO_2 and O_2.

4. The equation for excess air has been revised to account for the presence of CO.

5. A clearer distinction has been made between molecular weight determination and emission rate correction factor determination.

6. Single point, integrated sampling has been included.

METHOD 4

1. The sampling time of 1 hour has been changed to a total sampling time which will span the length of time the pollutant emission rate is being determined or such time as specified in an applicable subpart of the standards.

2. The requirement for proportional sampling has been dropped and replaced with the requirement for constant rate sampling.

3. The leak check before the test run has been made optional; the leak check after the run remains mandatory.

METHOD 5

1. The following alternatives have been included in the method:

a. The use of metal probe liners.

b. The use of other materials of construction for filter holders and probe liner parts.

c. The use of polyethylene wash bottles and sample storage containers.

d. The use of desiccants other than silica gel or calcium sulfate, when appropriate.

e. The use of stopcock grease other than silicone grease, when appropriate.

f. The drying of filters and probe-filter catches at elevated temperatures, when appropriate.

g. The combining of the filter and probe washes into one container.

2. The leak check prior to a test run has been made optional. The post-test leak check remains mandatory. A method for correcting sample volume for excessive leakage rates has been included.

3. Detailed leak check and calibration procedures for the metering system have been included.

METHOD 6

1. Possible interfering agents of the method have been delineated.

2. The options of: (a) using a Method 8 impinger system, or (b) determining SO_2 simultaneously with particulate matter, have been included in the method.

3. Based on recent research data, the requirement for proportional sampling has been dropped and replaced with the requirement for constant rate sampling.

4. Tests have shown that isopropanol obtained from commercial sources occasionally has peroxide impurities that will cause erroneously low SO_2 measurements. Therefore, a test for detecting peroxides in isopropanol has been included in the method.

5. The leak check before the test run has been made optional; the leak check after the run remains mandatory.

6. A detailed calibration procedure for the metering system has been included in the method.

METHOD 7

1. For variable wave length spectrophotometers, a scanning procedure for determining the point of maximum absorbance has been incorporated as an option.

METHOD 8

1. Known interfering compounds have been listed to avoid misapplication of the method.

2. The determination of filterable particulate matter (including acid mist) simultaneously with SO_3 and SO_2 has been allowed where applicable.

3. Since occasionally some commercially available quantities of isopropanol

have peroxide impurities that will cause erroneously high sulfuric acid mist measurements, a test for peroxides in isopropanol has been included in the method.

4. The gravimetric technique for moisture content (rather than volumetric) has been specified because a mixture of isopropyl alcohol and water will have a volume less than the sum of the volumes of its content.

5. A closer correspondence has been made between similar parts of Methods 8 and 5.

MISCELLANEOUS

Several commenters questioned the meaning of the term "subject to the approval of the Administrator" in relation to using alternate test methods and procedures. As defined in § 60.2 of subpart A, the "Administrator" includes any authorized representative of the Administrator of the Environmental Protection Agency. Authorized representatives are EPA officials in EPA Regional Offices or State, local, and regional governmental officials who have been delegated the responsibility of enforcing regulations under 40 CFR 60. These officials in consultation with other staff members familiar with technical aspects of source testing will render decisions regarding acceptable alternate test procedures.

In accordance with section 117 of the Act, publication of these methods was preceded by consultation with appropriate advisory committees, independent experts, and Federal departments and agencies.

(Secs. 111, 114 and 301(a) of the Clean Air Act, sec. 4(a) of Pub. L. No. 91-604, 84 Stat. 1683; sec. 4(a) of Pub. L. No. 91-604, 84 Stat. 1687; sec. 2 of Pub. L. No. 90-148, 81 Stat. 504 [42 U.S.C. 1857c-6, 1857c-9, 1857g(a)].)

NOTE.—The Environmental Protection Agency has determined that this document does not contain a major proposal requiring preparation of an Economic Impact Analysis under Executive Orders 11821 and 11949 and OMB Circular A-107.

Dated: August 16, 1977.

DOUGLAS M. COSTLE,
Administrator.

Part 60 of Chapter I of Title 40 of the Code of Federal Regulations is amended by revising Methods 1 through 8 of Appendix A—Reference Methods as follows:

APPENDIX A—REFERENCE METHODS

The reference methods in this appendix are referred to in § 60.8 (Performance Tests) and § 60.11 (Compliance With Standards and Maintenance Requirements) of 40 CFR Part 60, Subpart A (General Provisions). Specific uses of these reference methods are described in the standards of performance contained in the subparts, beginning with Subpart D.

Within each standard of performance, a section titled "Test Methods and Procedures" is provided to (1) identify the test methods applicable to the facility subject to the respective standard and (2) identify any special instructions or conditions to be followed when applying a method to the respective facility. Such instructions (for example, establish sampling rates, volumes, or temperatures) are to be used either in addition to, or as a substitute for procedures in a reference method. Similarly, for sources subject to emission monitoring requirements, specific instructions pertaining to any use of a reference method are provided in the subpart or in Appendix B.

Inclusion of methods in this appendix is not intended as an endorsement or denial of their applicability to sources that are not subject to standards of performance. The methods are potentially applicable to other sources; however, applicability should be confirmed by careful and appropriate evaluation of the conditions prevalent at such sources.

The approach followed in the formulation of the reference methods involves specifications for equipment, procedures, and performance. In concept, a performance specification approach would be preferable in all methods because this allows the greatest flexibility to the user. In practice, however, this approach is impractical in most cases because performance specifications cannot be established. Most of the methods described herein, therefore, involve specific equipment specifications and procedures, and only a few methods in this appendix rely on performance criteria.

Minor changes in the reference methods should not necessarily affect the validity of the results and it is recognized that alternative and equivalent methods exist. Section 60.8 provides authority for the Administrator to specify or approve (1) equivalent methods, (2) alternative methods, and (3) minor changes in the methodology of the reference methods. It should be clearly understood that unless otherwise identified all such methods and changes must have prior approval of the Administrator. An owner employing such methods or deviations from the reference methods without obtaining prior approval does so at the risk of subsequent disapproval and retesting with approved methods.

Within the reference methods, certain specific equipment or procedures are recognized as being acceptable or potentially acceptable and are specifically identified in the methods. The items identified as acceptable options may be used without approval but must be identified in the test report. The potentially approvable options are cited as "subject to the approval of the Administrator" or as "or equivalent." Such potentially approvable techniques or alternatives may be used at the discretion of the owner without prior approval. However, detailed descriptions for applying these potentially approvable techniques or alternatives are not provided in the reference methods. Also, the potentially approvable options are not necessarily acceptable in all applications. Therefore, an owner electing to use such potentially approvable techniques or alternatives is responsible for: (1) assuring that the techniques or alternatives are in fact applicable and are properly executed; (2) including a written description of the alternative method in the test report (the written method must be clear and must be capable of being performed without additional instruction, and the degree of detail should be similar to the detail contained in the reference methods); and (3) providing any rationale or supporting data necessary to show the validity of the alternative in the particular application. Failure to meet these requirements can result in the Administrator's disapproval of the alternative.

METHOD 1—SAMPLE AND VELOCITY TRAVERSES FOR STATIONARY SOURCES

1. *Principle and Applicability*

1.1 Principle. To aid in the representative measurement of pollutant emissions and/or total volumetric flow rate from a stationary source, a measurement site where the effluent stream is flowing in a known direction is selected, and the cross-section of the stack is divided into a number of equal areas. A traverse point is then located within each of these equal areas.

1.2 Applicability. This method is applicable to flowing gas streams in ducts, stacks, and flues. The method cannot be used when: (1) flow is cyclonic or swirling (see Section 2.4), (2) a stack is smaller than about 0.30 meter (12 in.) in diameter, or 0.071 m² (113 in.²) in cross-sectional area, or (3) the measurement site is less than two stack or duct diameters downstream or less than a half diameter upstream from a flow disturbance.

The requirements of this method must be considered before construction of a new facility from which emissions will be measured; failure to do so may require subsequent alterations to the stack or deviation from the standard procedure. Cases involving variants are subject to approval by the Administrator, U.S. Environmental Protection Agency.

2. *Procedure*

2.1 Selection of Measurement Site. Sampling or velocity measurement is performed at a site located at least eight stack or duct diameters downstream and two diameters upstream from any flow disturbance such as a bend, expansion, or contraction in the stack, or from a visible flame. If necessary, an alternative location may be selected, at a position at least two stack or duct diameters downstream and a half diameter upstream from any flow disturbance. For a rectangular cross section, an equivalent diameter (D_e) shall be calculated from the following equation, to determine the upstream and downstream distances:

$$D_e = \frac{2LW}{L+W}$$

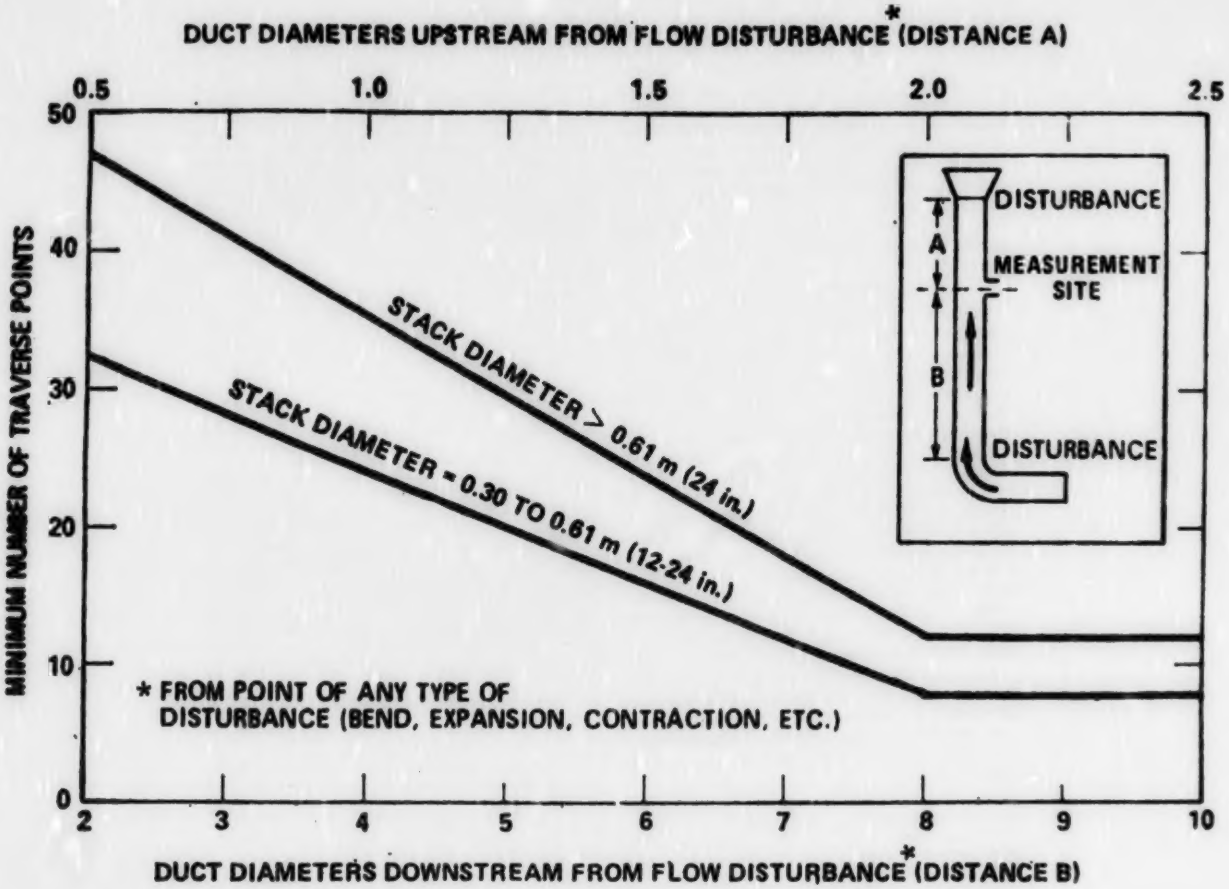

Figure 1-1. Minimum number of traverse points for particulate traverses.

where L=length and W=width.

2.2 Determining the Number of Traverse Points.

2.2.1 Particulate Traverses. When the eight- and two-diameter criterion can be met, the minimum number of traverse points shall be: (1) twelve, for circular or rectangular stacks with diameters (or equivalent diameters) greater than 0.61 meter (24 in.); (2) eight, for circular stacks with diameters between 0.30 and 0.61 meter (12-24 in.); (3) nine, for rectangular stacks with equivalent diameters between 0.30 and 0.61 meter (12-24 in.).

When the eight- and two-diameter criterion cannot be met, the minimum number of traverse points is determined from Figure 1-1. Before referring to the figure, however, determine the distances from the chosen measurement site to the nearest upstream and downstream disturbances, and divide each distance by the stack diameter or equivalent diameter, to determine the distance in terms of the number of duct diameters. Then, determine from Figure 1-1 the minimum number of traverse points that corresponds: (1) to the number of duct diameters upstream; and (2) to the number of diameters downstream. Select the higher of the two minimum numbers of traverse points, or a greater value, so that for circular stacks the number is a multiple of 4, and for rectangular stacks, the number is one of those shown in Table 1-1.

TABLE 1-1. *Cross-sectional layout for rectangular stacks*

Number of traverse points:	*Matrix layout*
9	3x3
12	4x3
16	4x4
20	5x4
25	5x5
30	6x5
36	6x6
42	7x6
49	7x7

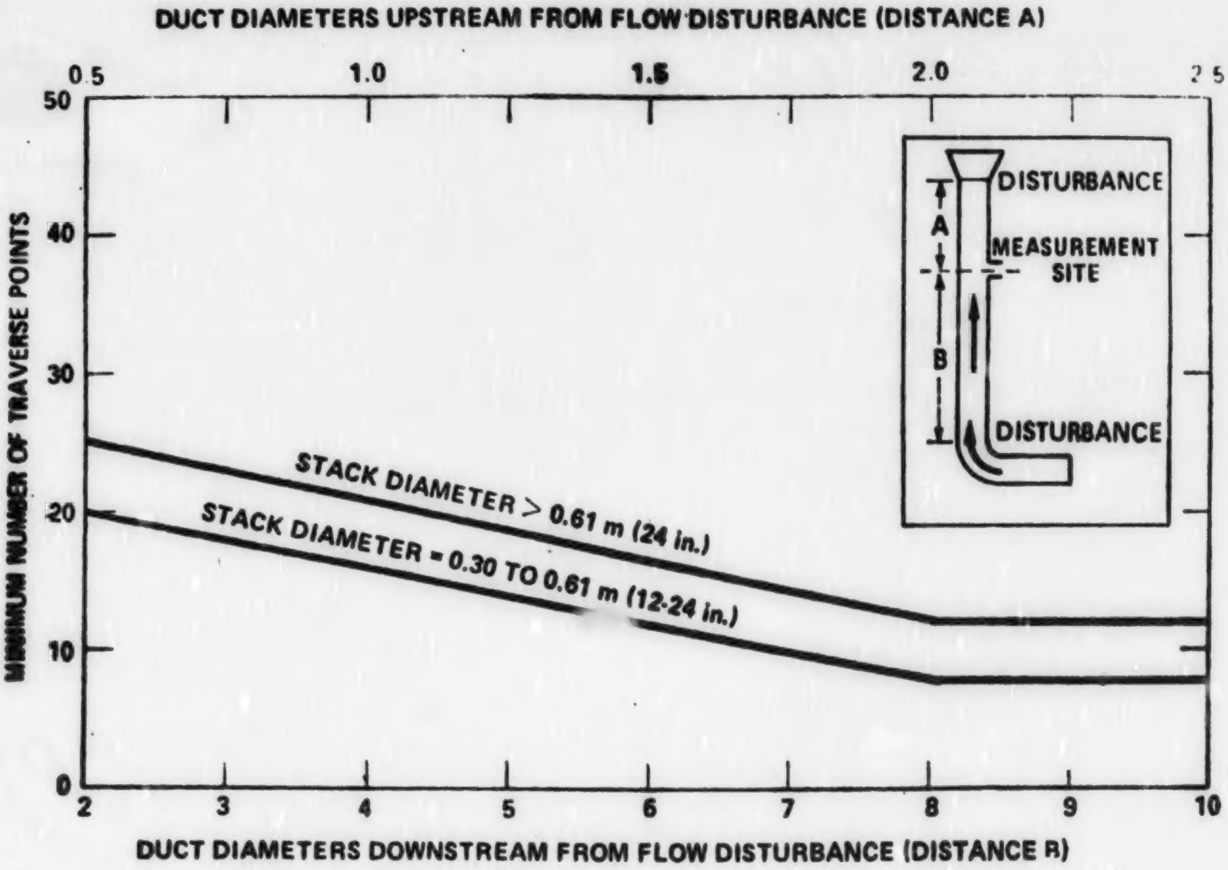

Figure 1-2. Minimum number of traverse points for velocity (nonparticulate) traverses.

2.2.2 Velocity (Non-Particulate) Traverses. When velocity or volumetric flow rate is to be determined (but not particulate matter), the same procedure as that for particulate traverses (Section 2.2.1) is followed, except that Figure 1-2 may be used instead of Figure 1-1.

2.3 Cross-Sectional Layout and Location of Traverse Points.

2.3.1 Circular Stacks. Locate the traverse points on two perpendicular diameters according to Table 1-2 and the example shown in Figure 1-3. Any equation (for examples, see Citations 2 and 3 in the Bibliography) that gives the same values as those in Table 1-2 may be used in lieu of Table 1-2.

For particulate traverses, one of the diameters must be in a plane containing the greatest expected concentration variation, e.g., after bends, one diameter shall be in the plane of the bend. This requirement becomes less critical as the distance from the disturbance increases; therefore, other diameter locations may be used, subject to approval of the Administrator.

In addition, for stacks having diameters greater than 0.61 m (24 in.) no traverse points shall be located within 2.5 centimeters (1.00 in.) of the stack walls; and for stack diameters equal to or less than 0.61 m (24 in.), no traverse points shall be located within 1.3 cm (0.50 in.) of the stack walls. To meet these criteria, observe the procedures given below.

2.3.1.1 Stacks With Diameters Greater Than 0.61 m (24 in.). When any of the traverse points as located in Section 2.3.1 fall within 2.5 cm (1.00 in.) of the stack walls, relocate them away from the stack walls to: (1) a distance of 2.5 cm (1.00 in.); or (2) a distance equal to the nozzle inside diameter, whichever is larger. These relocated traverse points (on each end of a diameter) shall be the "adjusted" traverse points.

Whenever two successive traverse points are combined to form a single adjusted traverse point, treat the adjusted point as two separate traverse points, both in the sampling (or velocity measurement) procedure, and in recording the data.

TRAVERSE POINT	DISTANCE, % of diameter
1	4.4
2	14.7
3	29.5
4	70.5
5	85.3
6	95.6

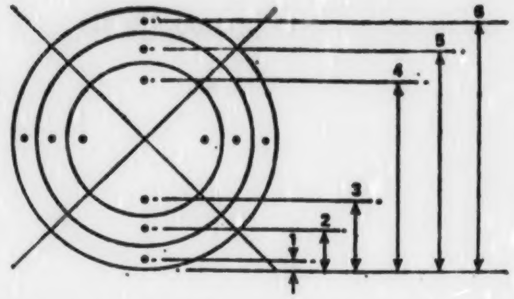

Figure 1-3. Example showing circular stack cross section divided into 12 equal areas, with location of traverse points indicated.

Table 1-2. LOCATION OF TRAVERSE POINTS IN CIRCULAR STACKS
(Percent of stack diameter from inside wall to traverse point)

Traverse point number on a diameter	Number of traverse points on a diameter											
	2	4	6	8	10	12	14	16	18	20	22	24
1	14.6	6.7	4.4	3.2	2.6	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	85.4	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3		75.0	29.6	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4		93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5			85.4	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6			95.6	80.6	65.8	35.6	26.9	22.0	18.8	16.5	14.6	13.2
7				89.5	77.4	64.4	36.6	28.3	23.6	20.4	18.0	16.1
8				96.8	85.4	75.0	63.4	37.5	29.6	25.0	21.8	19.4
9					91.8	82.3	73.1	62.5	38.2	30.6	26.2	23.0
10					97.4	88.2	79.9	71.7	61.8	38.8	31.5	27.2
11						93.3	85.4	78.0	70.4	61.2	39.3	32.3
12						97.9	90.1	83.1	76.4	69.4	60.7	39.8
13							94.3	87.5	81.2	75.0	68.5	60.2
14							98.2	91.5	85.4	79.6	73.8	67.7
15								95.1	89.1	83.5	78.2	72.8
16								98.4	92.5	87.1	82.0	77.0
17									95.6	90.3	85.4	80.6
18									98.6	93.3	88.4	83.9
19										96.1	91.3	86.8
20										98.7	94.0	89.5
21											96.5	92.1
22											98.9	94.5
23												96.8
24												98.9

2.3.1.2 Stacks With Diameters Equal to or Less Than 0.61 m (24 in.). Follow the procedure in Section 2.3.1.1, noting only that any "adjusted" points should be relocated away from the stack walls to: (1) a distance of 1.3 cm (0.50 in.); or (2) a distance equal to the nozzle inside diameter, whichever is larger.

2.3.2 Rectangular Stacks. Determine the number of traverse points as explained in Sections 2.1 and 2.2 of this method. From Table 1-1, determine the grid configuration. Divide the stack cross-section into as many equal rectangular elemental areas as traverse points, and then locate a traverse point at the centroid of each equal area according to the example in Figure 1-4.

The situation of traverse points being too close to the stack walls is not expected to arise with rectangular stacks. If this problem should ever arise, the Administrator must be contacted for resolution of the matter.

2.4 Verification of Absence of Cyclonic Flow. In most stationary sources, the direction of stack gas flow is essentially parallel to the stack walls. However, cyclonic flow may exist (1) after such devices as cyclones and inertial demisters following venturi scrubbers, or (2) in stacks having tangential inlets or other duct configurations which tend to induce swirling; in these instances, the presence or absence of cyclonic flow at the sampling location must be determined. The following techniques are acceptable for this determination.

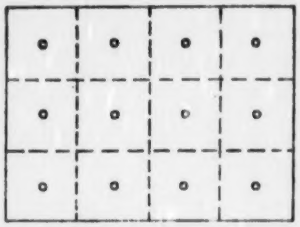

Figure 1-4. Example showing rectangular stack cross section divided into 12 equal areas, with a traverse point at centroid of each area.

Level and zero the manometer. Connect a Type S pitot tube to the manometer. Position the Type S pitot tube at each traverse point, in succession, so that the planes of the face openings of the pitot tube are perpendicular to the stack cross-sectional plane; when the Type S pitot tube is in this position, it is at "0° reference." Note the differential pressure (Δp) reading at each traverse point. If a null (zero) pitot reading is obtained at 0° reference at a given traverse point, an acceptable flow condition exists at that point. If the pitot reading is not zero at 0° reference, rotate the pitot tube (up to ±90° yaw angle), until a null reading is obtained. Carefully determine and record the value of the rotation angle (α) to the nearest degree. After the null technique has been applied at each travrse point, calculate the average of the absolute values of α; assign α values of 0° to those points for which no rotation was required, and include these in the overall average. If the average value of α is greater than 10°, the overall flow condition in the stack is unacceptable and alternative methodology, subject to the approval of the Administrator, must be used to perform accurate sample and velocity traverses.

3. *Bibliography*

1. Determining Dust Concentration in a Gas Stream. ASME. Performance Test Code No. 27. New York. 1957.

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3. Methods for Determination of Velocity, Volume, Dust and Mist Content of Gases. Western Precipitation Division of Joy Manufacturing Co. Los Angeles, CA. Bulletin WP-50. 1968.

4. Standard Method for Sampling Stacks for Particulate Matter. In: 1971 Book of ASTM Standards, Part 23. ASTM Designation D-2928-71. Philadelphia, Pa. 1971.

5. Hanson, H. A., et al. Particulate Sampling Strategies for Large Power Plants Including Nonuniform Flow. USEPA, ORD, ESRL, Research Triangle Park, N.C. EPA-600/2-76-170. June 1976.

6. Entropy Environmentalists, Inc. Determination of the Optimum Number of Sampling Points: An Analysis of Method 1 Criteria. Environmental Protection Agency. Research Triangle Park, N.C. EPA Contract No. [illegible]-3172, Task 7.

METHOD 2—DETERMINATION OF STACK GAS VELOCITY AND VOLUMETRIC FLOW RATE (TYPE S PITOT TUBE)

1. *Principle and Applicability*

1.1 Principle. The average gas velocity in a stack is determined from the gas density and from measurement of the average velocity head with a Type S (Stausscheibe or reverse type) pitot tube.

1.2 Applicability. This method is applicable for measurement of the average velocity of a gas stream and for quantifying gas flow.

This procedure is not applicable at measurement sites which fail to meet the criteria of Method 1, Section 2.1. Also, the method cannot be used for direct measurement in cyclonic or swirling gas streams; Section 2.4 of Method 1 shows how to determine cyclonic or swirling flow conditions. When unacceptable conditions exist, alternative procedures, subject to the approval of the Administrator, U.S. Environmental Protection Agency, must be employed to make accurate flow rate determinations; examples of such alternative procedures are: (1) to install straightening vanes; (2) to calculate the total volumetric flow rate stoichiometrically, or (3) to move to another measurement site at which the flow is acceptable.

2. *Apparatus*

Specifications for the apparatus are given below. Any other apparatus that has been demonstrated (subject to approval of the Administrator) to be capable of meeting the specifications will be considered acceptable.

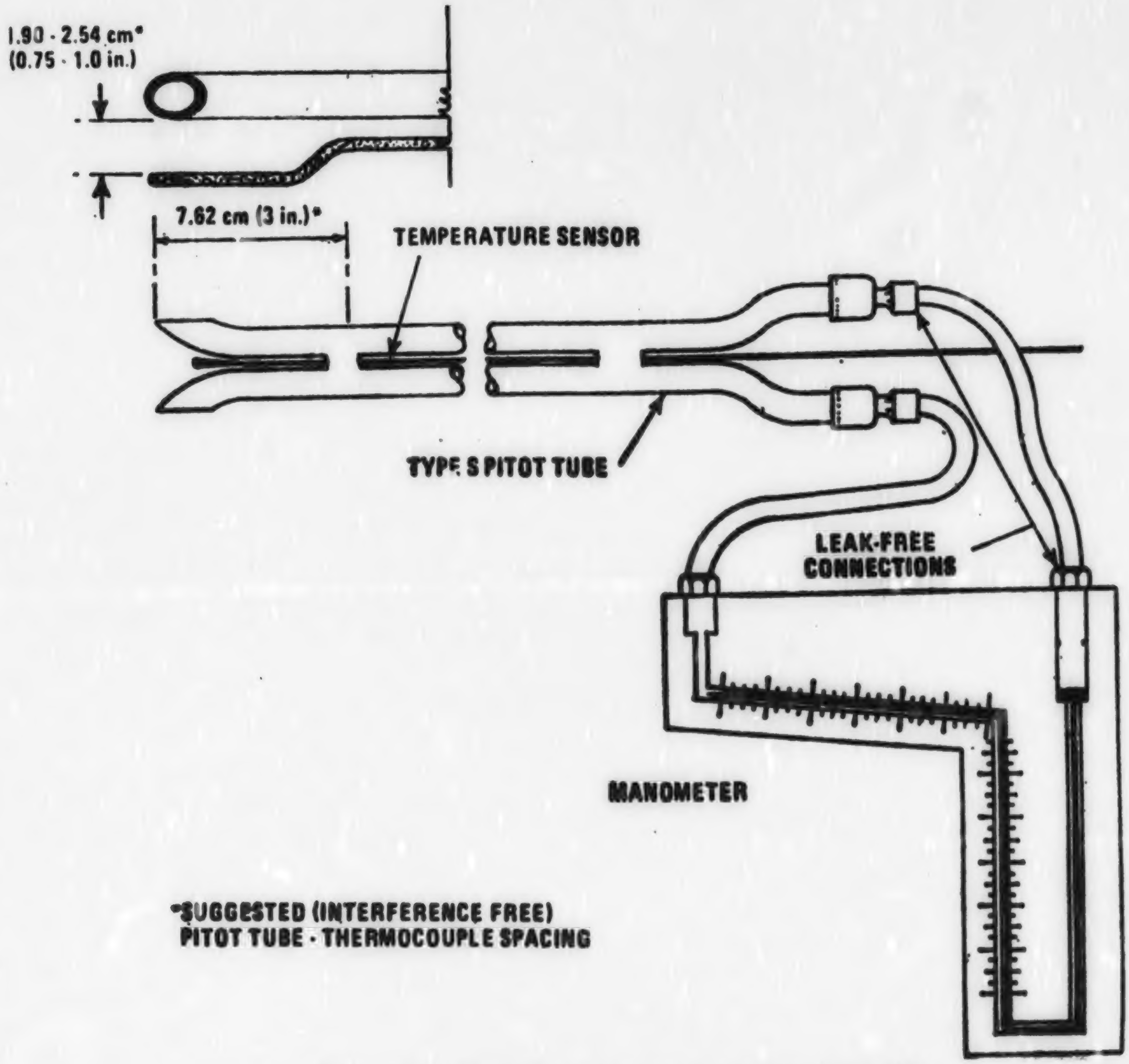
1.90 - 2.54 cm*
(0.75 - 1.0 in.)
7.62 cm (3 in.)*
TEMPERATURE SENSOR
TYPE S PITOT TUBE
LEAK-FREE CONNECTIONS
MANOMETER
*SUGGESTED (INTERFERENCE FREE)
PITOT TUBE - THERMOCOUPLE SPACING

Figure 2-1. Type S pitot tube manometer assembly.

2.1 Type S Pitot Tube. The Type S pitot tube (Figure 2-1) shall be made of metal tubing (e.g., stainless steel). It is recommended that the external tubing diameter (dimension D_t, Figure 2-2b) be between 0.48 and 0.95 centimeters ($\frac{3}{16}$ and $\frac{3}{8}$ inch). There shall be an equal distance from the base of each leg of the pitot tube to its face-opening plane (dimensions P_A and P_B, Figure 2-2b); it is recommended that this distance be between 1.05 and 1.50 times the external tubing diameter. The face openings of the pitot tube shall, preferably, be aligned as shown in Figure 2-2; however, slight misalignments of the openings are permissible (see Figure 2-3).

The Type S pitot tube shall have a known coefficient, determined as outlined in Section 4. An identification number shall be assigned to the pitot tube; this number shall be permanently marked or engraved on the body of the tube.

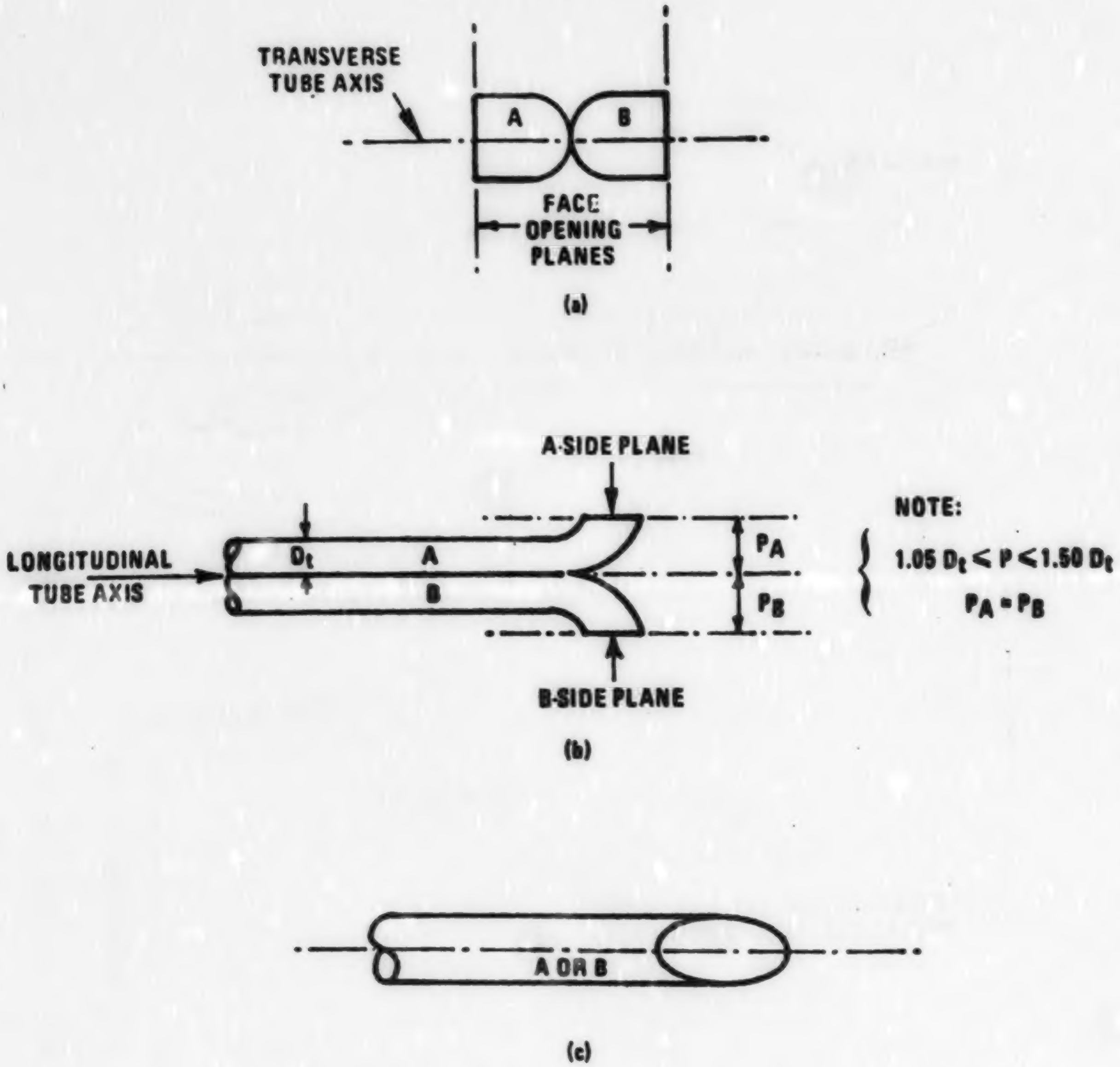
TRANSVERSE TUBE AXIS
A
B
FACE OPENING PLANES
(a)
A-SIDE PLANE
LONGITUDINAL TUBE AXIS
D_t
A
B
P_A
P_B
NOTE:
$1.05\ D_t < P < 1.50\ D_t$
$P_A = P_B$
B-SIDE PLANE
(b)
A OR B
(c)

Figure 2-2. Properly constructed Type S pitot tube, shown in: (a) end view; face opening planes perpendicular to transverse axis; (b) top view; face opening planes parallel to longitudinal axis; (c) side view; both legs of equal length and centerlines coincident, when viewed from both sides. Baseline coefficient values of 0.84 may be assigned to pitot tubes constructed this way.

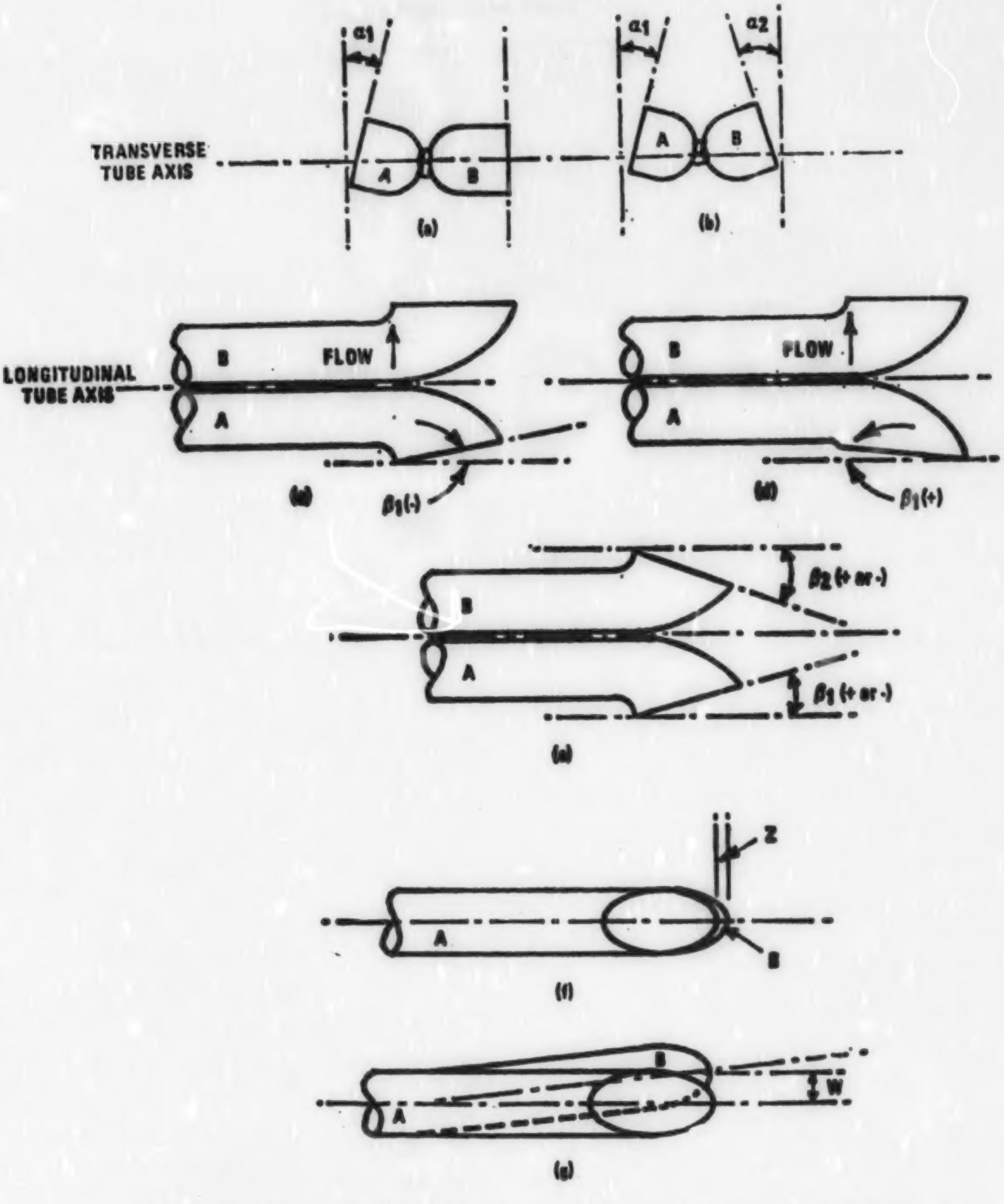
α_1
α_1
α_2
TRANSVERSE TUBE AXIS
A
B
A
B
(a)
(b)
LONGITUDINAL TUBE AXIS
B
FLOW
A
B
FLOW
A
(c)
β_1(-)
(d)
β_1(+)
B
A
β_2 (+ or -)
β_1 (+ or -)
(e)
Z
A
B
(f)
B
A
W
(g)

Figure 2-3. Types of face-opening misalignment that can result from field use or improper construction of Type S pitot tubes. These will not affect the baseline value of $\bar{C}p(s)$ so long as α_1 and $\alpha_2 < 10^\circ$, β_1 and $\beta_2 < 5^\circ$. $z < 0.32$ cm (1/8 in.) and $w <$ 0.08 cm (1/32 in.) (citation 11 in Section 6).

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A standard pitot tube may be used instead of a Type S, provided that it meets the specifications of Sections 2.7 and 4.2; note, however, that the static and impact pressure holes of standard pitot tubes are susceptible to plugging in particulate-laden gas streams. Therefore, whenever a standard pitot tube is used to perform a traverse, adequate proof must be furnished that the openings of the pitot tube have not plugged up during the traverse period; this can be done by taking a velocity head (Δp) reading at the final traverse point, cleaning out the impact and static holes of the standard pitot tube by "back-purging" with pressurized air, and then taking another Δp reading. If the Δp readings made before and after the air purge are the same ($\pm$5 percent), the traverse is acceptable. Otherwise, reject the run. Note that if Δp at the final traverse point is unsuitably low, another point may be selected. If "back-purging" at regular intervals is part of the procedure, then comparative Δp readings shall be taken, as above, for the last two back purges at which suitably high Δp readings are observed.

2.2 Differential Pressure Gauge. An inclined manometer or equivalent device is used. Most sampling trains are equipped with a 10-in. (water column) inclined-vertical manometer, having 0.01-in. H_2O divisions on the 0- to 1-in. inclined scale, and 0.1-in. H_2O divisions on the 1- to 10-in. vertical scale. This type of manometer (or other gauge of equivalent sensitivity) is satisfactory for the measurement of Δp values as low as 1.3 mm (0.05 in.) H_2O. However, a differential pressure gauge of greater sensitivity shall be used (subject to the approval of the Administrator), if any of the following is found to be true: (1) the arithmetic average of all Δp readings at the traverse points in the stack is less than 1.3 mm (0.05 in.) H_2O; (2) for traverses of 12 or more points, more than 10 percent of the individual Δp readings are below 1.3 mm (0.05 in.) H_2O; (3) for traverses of fewer than 12 points, more than one Δp reading is below 1.3 mm (0.05 in.) H_2O. Citation 18 in Section 6 describes commercially available instrumentation for the measurement of low-range gas velocities.

As an alternative to criteria (1) through (3) above, the following calculation may be performed to determine the necessity of using a more sensitive differential pressure gauge:

$$T=\frac{\sum_{i=1}^{n}\sqrt{\Delta p_i+K}}{\sum_{i=1}^{n}\sqrt{\Delta p_i}}$$

where:

Δp_i = Individual velocity head reading at a traverse point, mm H_2O (in. H_2O).

n = Total number of traverse points.

K = 0.13 mm H_2O when metric units are used and 0.005 in H_2O when English units are used.

If T is greater than 1.05, the velocity head data are unacceptable and a more sensitive differential pressure gauge must be used.

NOTE.—If differential pressure gauges other than inclined manometers are used (e.g., magnehelic gauges), their calibration must be checked after each test series. To check the calibration of a differential pressure gauge, compare Δp readings of the gauge with those of a gauge-oil manometer at a minimum of three points, approximately representing the range of Δp values in the stack. If, at each point, the values of Δp as read by the differential pressure gauge and gauge-oil manometer agree to within 5 percent, the differential pressure gauge shall be considered to be in proper calibration. Otherwise, the test series shall either be voided, or procedures to adjust the measured Δp values and final results shall be used, subject to the approval of the Administrator.

2.3 Temperature Gauge. A thermocouple, liquid-filled bulb thermometer, bimetallic thermometer, mercury-in-glass thermometer, or other gauge capable of measuring temperature to within 1.5 percent of the minimum absolute stack temperature shall be used. The temperature gauge shall be attached to the pitot tube such that the sensor tip does not touch any metal; the gauge shall be in an interference-free arrangement with respect to the pitot tube face openings (see Figure 2-1 and also Figure 2-7 in Section 4). Alternate positions may be used if the pitot tube-temperature gauge system is calibrated according to the procedure of Section 4. Provided that a difference of not more than 1 percent in the average velocity measurement is introduced, the temperature gauge need not be attached to the pitot tube; this alternative is subject to the approval of the Administrator.

2.4 Pressure Probe and Gauge. A piezometer tube and mercury- or water-filled U-tube manometer capable of measuring stack pressure to within 2.5 mm (0.1 in.) Hg is used. The static tap of a standard type pitot tube or one leg of a Type S pitot tube with the face opening planes positioned parallel to the gas flow may also be used as the pressure probe.

2.5 Barometer. A mercury, aneroid, or other barometer capable of measuring atmospheric pressure to within 2.5 mm Hg (0.1 in. Hg) may be used. In many cases, the barometric reading may be obtained from a nearby national weather service station, in which case the station value (which is the absolute barometric pressure) shall be requested and an adjustment for elevation differences between the weather station and the sampling point shall be applied at a rate of minus 2.5 mm (0.1 in.) Hg per 30-meter (100 foot) elevation increase, or vice-versa for elevation decrease.

2.6 Gas Density Determination Equipment. Method 3 equipment, if needed (see Section 3.6), to determine the stack gas dry molecular weight, and Reference Method 4 or Method 5 equipment for moisture content determination; other methods may be used subject to approval of the Administrator.

2.7 Calibration Pitot Tube. When calibration of the Type S pitot tube is necessary (see Section 4), a standard pitot tube is used as a reference. The standard pitot tube shall, preferably, have a known coefficient, obtained either (1) directly from the National Bureau of Standards, Route 270, Quince Orchard Road, Gaithersburg, Maryland, or (2) by calibration against another standard pitot tube with an NBS-traceable coefficient. Alternatively, a standard pitot tube designed according to the criteria given in 2.7.1 through 2.7.5 below and illustrated in Figure 2-4 (see also Citations 7, 8, and 17 in Section 6) may be used. Pitot tubes designed according to these specifications will have baseline coefficients of about 0.99±0.01.

2.7.1 Hemispherical (shown in Figure 2-4), ellipsoidal, or conical tip.

2.7.2 A minimum of six diameters straight run (based upon D, the external diameter of the tube) between the tip and the static pressure holes.

2.7.3 A minimum of eight diameters straight run between the static pressure holes and the centerline of the external tube, following the 90 degree bend.

2.7.4 Static pressure holes of equal size (approximately 0.1 D), equally spaced in a piezometer ring configuration.

2.7.5 Ninety degree bend, with curved or mitered junction.

2.8 Differential Pressure Gauge for Type S Pitot Tube Calibration. An inclined manometer or equivalent is used. If the single-velocity calibration technique is employed (see Section 4.1.2.3), the calibration differential pressure gauge shall be readable to the nearest 0.13 mm H_2O (0.005 in. H_2O). For multivelocity calibrations, the gauge shall be readable to the nearest 0.13 mm H_2O (0.005 in H_2O) for Δp values between 1.3 and 25 mm H_2O (0.05 and 1.0 in. H_2O), and to the nearest 1.3 mm H_2O (0.05 in. H_2O) for Δp values above 25 mm H_2O (1.0 in. H_2O). A special, more sensitive gauge will be required to read Δp values below 1.3 mm H_2O [0.05 in. H_2O] (see Citation 18 in Section 6).

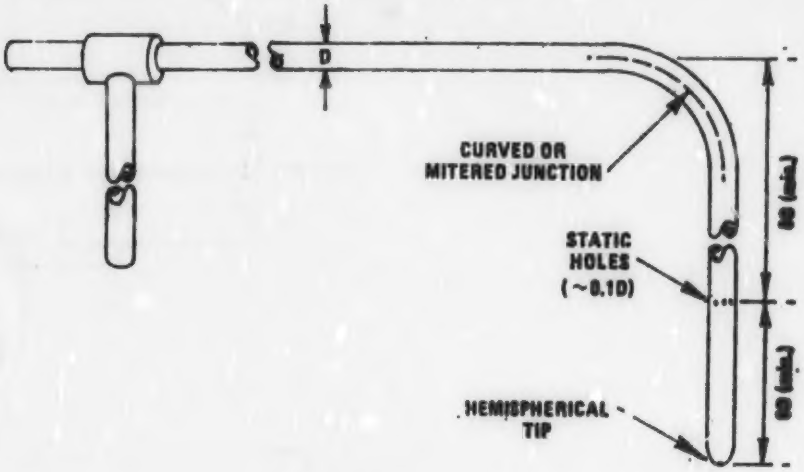


Figure 2-4. Standard pitot tube design specifications.

3. *Procedure*

3.1 Set up the apparatus as shown in Figure 2-1. Capillary tubing or surge tanks installed between the manometer and pitot tube may be used to dampen Δp fluctuations. It is recommended, but not required, that a pretest leak-check be conducted, as follows: (1) blow through the pitot impact opening until at least 7.6 cm (3 in.) H_2O velocity pressure registers on the manometer; then, close off the impact opening. The pressure shall remain stable for at least 15 seconds; (2) do the same for the static pressure side, except using suction to obtain the minimum of 7.6 cm (3 in.) H_2O. Other leak-check procedures, subject to the approval of the Administrator, may be used.

3.2 Level and zero the manometer. Because the manometer level and zero may drift due to vibrations and temperature changes, make periodic checks during the traverse. Record all necessary data as shown in the example data sheet (Figure 2-5).

3.3 Measure the velocity head and temperature at the traverse points specified by Method 1. Ensure that the proper differential pressure gauge is being used for the range of Δp values encountered (see Section 2.2). If it is necessary to change to a more sensitive gauge, do so, and remeasure the Δp and temperature readings at each traverse point. Conduct a post-test leak-check (mandatory), as described in Section 3.1 above, to validate the traverse run.

3.4 Measure the static pressure in the stack. One reading is usually adequate.

3.5 Determine the atmospheric pressure.

PLANT ______________________________

DATE ______________ RUN NO. ______________

STACK DIAMETER OR DIMENSIONS, m(in.) ______________

BAROMETRIC PRESSURE, mm Hg (in. Hg) ______________

CROSS SECTIONAL AREA, m^2 (ft^2) ______________

OPERATORS ______________

PITOT TUBE I.D. NO. ______________

AVG. COEFFICIENT, C_p = ______________

LAST DATE CALIBRATED ______________

SCHEMATIC OF STACK CROSS SECTION

Traverse Pt. No.	Vel. Hd., Δp mm (in.) H_2O	Stack Temperature		P_g mm Hg (in.Hg)	$\sqrt{\Delta p}$
		t_s, °C (°F)	T_s, °K (°R)		
		Average			

Figure 2-5. Velocity traverse data.

3.6 Determine the stack gas dry molecular weight. For combustion processes or processes that emit essentially CO_2, O_2, CO, and N_2, use Method 3. For processes emitting essentially air, an analysis need not be conducted; use a dry molecular weight of 29.0. For other processes, other methods, subject to the approval of the Administrator, must be used.

3.7 Obtain the moisture content from Reference Method 4 (or equivalent) or from Method 5.

3.8 Determine the cross-sectional area of the stack or duct at the sampling location. Whenever possible, physically measure the stack dimensions rather than using blueprints.

4. Calibration

4.1 Type S Pitot Tube. Before its initial use, carefully examine the Type S pitot tube in top, side, and end views to verify that the face openings of the tube are aligned within the specifications illustrated in Figure 2-2 or 2-3. The pitot tube shall not be used if it fails to meet these alignment specifications.

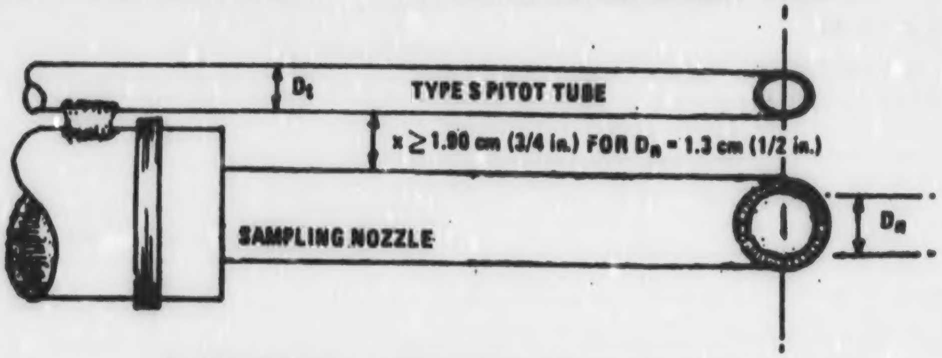
After verifying the face opening alignment, measure and record the following dimensions of the pitot tube: (a) the external tubing diameter (dimension D_t, Figure 2-2b); and (b) the base-to-opening plane distances (dimensions P_A and P_B, Figure 2-2b). If D_t is between 0.48 and 0.95 cm (3/16 and 3/8 in.) and if P_A and P_B are equal and between 1.05 and 1.50 D_t, there are two possible options: (1) the pitot tube may be calibrated according to the procedure outlined in Sections 4.1.2 through 4.1.5 below, or (2) a baseline (isolated tube) coefficient value of 0.84 may be assigned to the pitot tube. Note, however, that if the pitot tube is part of an assembly, calibration may still be required, despite knowledge of the baseline coefficient value (see Section 4.1.1).

If D_t, P_A, and P_B are outside the specified limits, the pitot tube must be calibrated as outlined in 4.1.2 through 4.1.5 below.

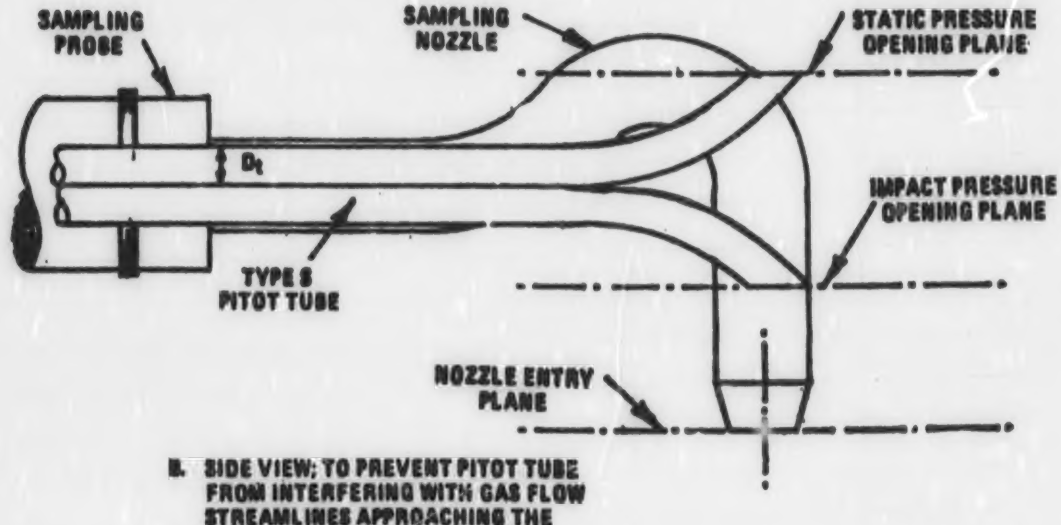
4.1.1 Type S Pitot Tube Assemblies. During sample and velocity traverses, the isolated Type S pitot tube is not always used; in many instances, the pitot tube is used in combination with other source-sampling components (thermocouple, sampling probe, nozzle) as part of an "assembly." The presence of other sampling components can sometimes affect the baseline value of the Type S pitot tube coefficient (Citation 9 in Section 6); therefore an assigned (or otherwise known) baseline coefficient value may or may not be valid for a given assembly. The baseline and assembly coefficient values will be identical only when the relative placement of the components in the assembly is such that aerodynamic interference effects are eliminated. Figures 2-6 through 2-8 illustrate interference-free component arrangements for Type S pitot tubes having external tubing diameters between 0.48 and 0.95 cm (3/16 and 3/8 in.). Type S pitot tube assemblies that fail to meet any or all of the specifications of Figures 2-6 through 2-8 shall be calibrated according to the procedure outlined in Sections 4.1.2 through 4.1.5 below, and prior to calibration, the values of the intercomponent spacings (pitot-nozzle, pitot-thermocouple, pitot-probe sheath) shall be measured and recorded.

NOTE.—Do not use any Type S pitot tube assembly which is constructed such that the impact pressure opening plane of the pitot tube is below the entry plane of the nozzle (see Figure 2-6b).

4.1.2 Calibration Setup. If the Type S pitot tube is to be calibrated, one leg of the tube shall be permanently marked A, and the other, B. Calibration shall be done in a flow system having the following essential design features:



A. BOTTOM VIEW; SHOWING MINIMUM PITOT-NOZZLE SEPARATION.



B. SIDE VIEW; TO PREVENT PITOT TUBE FROM INTERFERING WITH GAS FLOW STREAMLINES APPROACHING THE NOZZLE, THE IMPACT PRESSURE OPENING PLANE OF THE PITOT TUBE SHALL BE EVEN WITH OR ABOVE THE NOZZLE ENTRY PLANE.

Figure 2-6. Proper pitot tube - sampling nozzle configuration to prevent aerodynamic interference; buttonhook - type nozzle; centers of nozzle and pitot opening aligned; D_t between 0.48 and 0.95 cm (3/16 and 3/8 in.).

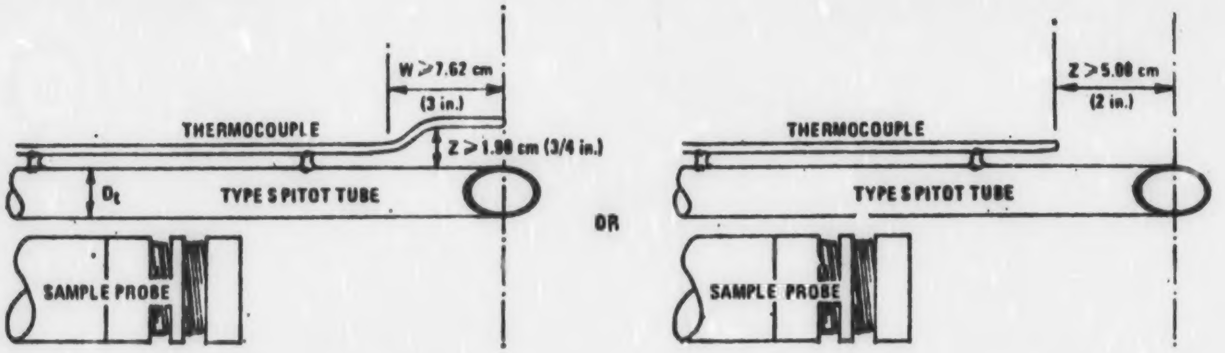


Figure 2-7. Proper thermocouple placement to prevent interference; D_t between 0.48 and 0.95 cm (3/16 and 3/8 in.).

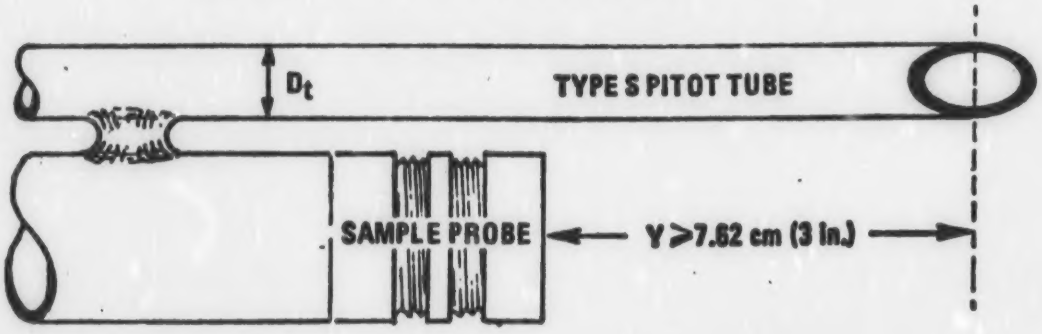


Figure 2-8. Minimum pitot-sample probe separation needed to prevent interference; D_t between 0.48 and 0.95 cm (3/16 and 3/8 in.).

4.1.2.1 The flowing gas stream must be confined to a duct of definite cross-sectional area, either circular or rectangular. For circular cross-sections, the minimum duct diameter shall be 30.5 cm (12 in.); for rectangular cross-sections, the width (shorter side) shall be at least 25.4 cm (10 in.).

4.1.2.2 The cross-sectional area of the calibration duct must be constant over a distance of 10 or more duct diameters. For a rectangular cross-section, use an equivalent diameter, calculated from the following equation, to determine the number of duct diameters:

$$D_e = \frac{2\,LW}{(L+W)}$$

Equation 2-1

where:

D_e=Equivalent diameter
L=Length
W=Width

To ensure the presence of stable, fully developed flow patterns at the calibration site, or "test section," the site must be located at least eight diameters downstream and two diameters upstream from the nearest disturbances.

NOTE.—The eight- and two-diameter criteria are not absolute; other test section locations may be used (subject to approval of the Administrator), provided that the flow at the test site is stable and demonstrably parallel to the duct axis.

4.1.2.3 The flow system shall have the capacity to generate a test-section velocity around 915 m/min (3,000 ft/min). This velocity must be constant with time to guarantee steady flow during calibration. Note that Type S pitot tube coefficients obtained by single-velocity calibration at 915 m/min (3,000 ft/min) will generally be valid to within ±3 percent for the measurement of velocities above 305 m/min (1,000 ft/min) and to within ±5 to 6 percent for the measurement of velocities between 180 and 305 m/min (600 and 1,000 ft/min). If a more precise correlation between C_p and velocity is desired, the flow system shall have the capacity to generate at least four distinct, time-invariant test-section velocities covering the velocity range from 180 to 1,525 m/min (600 to 5,000 ft/min), and calibration data shall be taken at regular velocity intervals over this range (see Citations 9 and 14 in Section 6 for details).

4.1.2.4 Two entry ports, one each for the standard and Type S pitot tubes, shall be cut in the test section; the standard pitot entry port shall be located slightly downstream of the Type S port, so that the standard and Type S impact openings will lie in the same cross-sectional plane during calibration. To facilitate alignment of the pitot tubes during calibration, it is advisable that the test section be constructed of plexiglas or some other transparent material.

4.1.3 Calibration Procedure. Note that this procedure is a general one and must not be used without first referring to the special considerations presented in Section 4.1.5. Note also that this procedure applies only to single-velocity calibration. To obtain calibration data for the A and B sides of the Type S pitot tube, proceed as follows:

4.1.3.1 Make sure that the manometer is properly filled and that the oil is free from contamination and is of the proper density. Inspect and leak-check all pitot lines; repair or replace if necessary.

4.1.3.2 Level and zero the manometer. Turn on the fan and allow the flow to stabilize. Seal the Type S entry port.

4.1.3.3 Ensure that the manometer is level and zeroed. Position the standard pitot tube at the calibration point (determined as outlined in Section 4.1.5.1), and align the tube so that its tip is pointed directly into the flow. Particular care should be taken in aligning the tube to avoid yaw and pitch angles. Make sure that the entry port surrounding the tube is properly sealed.

4.1.3.4 Read Δp_{std} and record its value in a data table similar to the one shown in Figure 2-9. Remove the standard pitot tube from the duct and disconnect it from the manometer. Seal the standard entry port.

4.1.3.5 Connect the Type S pitot tube to the manometer. Open the Type S entry port. Check the manometer level and zero. Insert and align the Type S pitot tube so that its A side impact opening is at the same point as was the standard pitot tube and is pointed directly into the flow. Make sure that the entry port surrounding the tube is properly sealed.

4.1.3.6 Read Δp_s and enter its value in the data table. Remove the Type S pitot tube from the duct and disconnect it from the manometer.

4.1.3.7 Repeat steps 4.1.3.3 through 4.1.3.6 above until three pairs of Δp readings have been obtained.

4.1.3.8 Repeat steps 4.1.3.3 through 4.1.3.7 above for the B side of the Type S pitot tube.

4.1.3.9 Perform calculations, as described in Section 4.1.4 below.

4.1.4 Calculations.

4.1.4.1 For each of the six pairs of Δp readings (i.e., three from side A and three from side B) obtained in Section 4.1.3 above, calculate the value of the Type S pitot tube coefficient as follows:

PITOT TUBE IDENTIFICATION NUMBER: ____________ DATE: ________

CALIBRATED BY: ______________________________

	"A" SIDE CALIBRATION			
RUN NO.	Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \overline{C}_p(A)$
1				
2				
3				
		$\overline{C}_p$ (SIDE A)		

	"B" SIDE CALIBRATION			
RUN NO.	Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \overline{C}_p(B)$
1				
2				
3				
		$\overline{C}_p$ (SIDE B)		

$$\text{AVERAGE DEVIATION} = \sigma\,(\text{A OR B}) = \frac{\sum_{1}^{3} \left| C_{p(s)} - \overline{C}_p(\text{A OR B}) \right|}{3} \longleftarrow \text{MUST BE} < 0.01$$

$$\left| \overline{C}_p\,(\text{SIDE A}) - \overline{C}_p\,(\text{SIDE B}) \right| \longleftarrow \text{MUST BE} < 0.01$$

Figure 2-9. Pitot tube calibration data.

$$C_{p(s)} = C_{p(std)} \sqrt{\frac{\Delta p_{std}}{\Delta p_s}}$$

Equation 2-2

where:

$C_{p(s)}$ = Type S pitot tube coefficient

$C_{p(std)}$ = Standard pitot tube coefficient; use 0.99 if the coefficient is unknown and the tube is designed according to the criteria of Sections 2.7.1 to 2.7.5 of this method.

Δp_{std} = Velocity head measured by the standard pitot tube, cm H_2O (in. H_2O)

Δp_s = Velocity head measured by the Type S pitot tube, cm H_2O (in. H_2O)

4.1.4.2 Calculate $\overline{C}_p$ (side A), the mean A-side coefficient, and $\overline{C}_p$ (side B), the mean B-side coefficient; calculate the difference between these two average values.

4.1.4.3 Calculate the deviation of each of the three A-side values of $C_{p(s)}$ from $\overline{C}_p$ (side A), and the deviation of each B side value of $C_{p(s)}$ from $\overline{C}_p$ (side B). Use the following equation:

$$\text{Deviation} = C_{p(s)} - \overline{C}_p(\text{A or B})$$

Equation 2-3

4.1.4.4 Calculate σ, the average deviation from the mean, for both the A and B sides of the pitot tube. Use the following equation:

$$\sigma\,(\text{side A or B}) = \frac{\sum_{1}^{3} \left| C_{p(s)} - \overline{C}_p(A \text{ or } B) \right|}{3}$$

Equation 2-4

4.1.4.5 Use the Type S pitot tube only if the values of σ (side A) and σ (side B) are less than or equal to 0.01 and if the absolute value of the difference between $\overline{C}_p$ (A) and $\overline{C}_p$ (B) is 0.01 or less.

4.1.5 Special considerations.

4.1.5.1 Selection of calibration point.

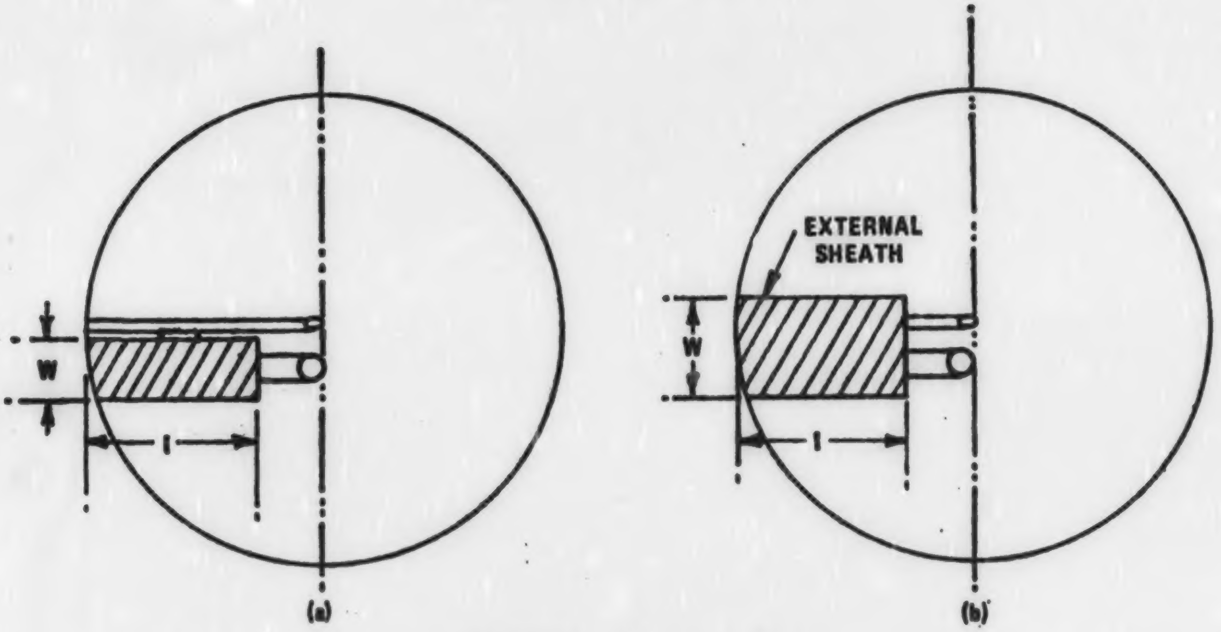
4.1.5.1.1 When an isolated Type S pitot tube is calibrated, select a calibration point at or near the center of the duct, and follow the procedures outlined in Sections 4.1.3 and 4.1.4 above. The Type S pitot coefficients so obtained, i.e., $\overline{C}_p$ (side A) and $\overline{C}_p$ (side B), will be valid, so long as either: (1) the isolated pitot tube is used; or (2) the pitot tube is used with other components (nozzle, thermocouple, sample probe) in an arrangement that is free from aerodynamic interference effects (see Figures 2-5 through 2-8).

4.1.5.1.2 For Type S pitot tube-thermocouple combinations (without sample probe), select a calibration point at or near the center of the duct, and follow the procedures outlined in Sections 4.1.3 and 4.1.4 above. The coefficients so obtained will be valid so long as the pitot tube-thermocouple combination is used by itself or with other components in an interference-free arrangement (Figures 2-5 and 2-7).

4.1.5.1.3 For assemblies with sample probes, the calibration point should be located at or near the center of the duct; however, insertion of a probe sheath into a small duct may cause significant cross-sectional area blockage and yield incorrect coefficient values (Citation 9 in Section 6). Therefore, to minimize the blockage effect, the calibration point may be a few inches off-center if necessary. The actual blockage effect will be negligible when the theoretical blockage, as determined by a projected-area model of the probe sheath, is 2 percent or less of the duct cross-sectional area for assemblies without external sheaths (Figure 2-10a), and 3 percent or less for assemblies with external sheaths (Figure 2-10b).

4.1.5.2 For those probe assemblies in which pitot tube-nozzle interference is a factor (i.e., those in which the pitot-nozzle separation distance fails to meet the specification illustrated in Figure 2-6a), the value of $C_{p(s)}$ depends upon the amount of free-space between the tube and nozzle, and therefore is a function of nozzle size. In these instances, separate calibrations shall be performed with each of the commonly used nozzle sizes in place. Note that the single-velocity calibration technique is acceptable for this purpose, even though the larger nozzle sizes (>0.635 cm or ¼ in.) are not ordinarily used for isokinetic sampling at velocities around 910 m/min (3,000 ft/min), which is the calibration velocity; note also that it is not necessary to draw an isokinetic sample during calibration (see Citation 19 in Section 6).

4.1.5.3 For a probe assembly constructed such that its pitot tube is always used in the same orientation, only one side of the pitot tube need be calibrated (the side which will face the flow). The pitot tube must still meet the alignment specifications of Figure 2-2 or 2-3, however, and must have an average deviation (σ) value of 0.01 or less (see Section 4.1.4.4).



$$\text{ESTIMATED SHEATH BLOCKAGE (\%)} = \left[\frac{l \times W}{\text{DUCT AREA}}\right] \times 100$$

Figure 2-10. Projected-area models for typical pitot tube assemblies.

4.1.6 Field Use and Recalibration.

4.1.6.1 Field Use.

4.1.6.1.1 When a Type S pitot tube (isolated tube or assembly) is used in the field, the appropriate coefficient value (whether assigned or obtained by calibration) shall be used to perform velocity calculations. For calibrated Type S pitot tubes, the A side coefficient shall be used when the A side of the tube faces the flow, and the B side coefficient shall be used when the B side faces the flow; alternatively, the arithmetic average of the A and B side coefficient values may be used, irrespective of which side faces the flow.

4.1.6.1.2 When a probe assembly is used to sample a small duct (12 to 36 in. in diameter), the probe sheath sometimes blocks a significant part of the duct cross-section, causing a reduction in the effective value of $\bar{C}_{p(s)}$. Consult Citation 9 in Section 6 for details. Conventional pitot-sampling probe assemblies are not recommended for use in ducts having inside diameters smaller than 12 inches (Citation 16 in Section 6).

4.1.6.2 Recalibration.

4.1.6.2.1 Isolated Pitot Tubes. After each field use, the pitot tube shall be carefully reexamined in top, side, and end views. If the pitot face openings are still aligned within the specifications illustrated in Figure 2-2 or 2-3, it can be assumed that the baseline coefficient of the pitot tube has not changed. If, however, the tube has been damaged to the extent that it no longer meets the specifications of Figure 2-2 or 2-3, the damage shall either be repaired to restore proper alignment of the face openings or the tube shall be discarded.

4.1.6.2.2 Pitot Tube Assemblies. After each field use, check the face opening alignment of the pitot tube, as in Section 4.1.6.2.1; also, remeasure the intercomponent spacings of the assembly. If the intercomponent spacings have not changed and the face opening alignment is acceptable, it can be assumed that the coefficient of the assembly has not changed. If the face opening alignment is no longer within the specifications of Figures 2-2 or 2-3, either repair the damage or replace the pitot tube (calibrating the new assembly, if necessary). If the intercomponent spacings have changed, restore the original spacings or recalibrate the assembly.

4.2 Standard pitot tube (if applicable). If a standard pitot tube is used for the velocity traverse, the tube shall be constructed according to the criteria of Section 2.7 and shall be assigned a baseline coefficient value of 0.99. If the standard pitot tube is used as part of an assembly, the tube shall be in an interference-free arrangement (subject to the approval of the Administrator).

4.3 Temperature Gauges. After each field use, calibrate dial thermometers, liquid-filled bulb thermometers, thermocouple-potentiometer systems, and other gauges at a temperature within 10 percent of the average absolute stack temperature. For temperatures up to 405° C (761° F), use an ASTM mercury-in-glass reference thermometer, or equivalent, as a reference; alternatively, either a reference thermocouple and potentiometer (calibrated by NBS) or thermometric fixed points, e.g., ice bath and boiling water (corrected for barometric pressure) may be [illegible]. For temperatures above 405° C (761° F), use an NBS-calibrated reference thermocouple-potentiometer system or an alternate reference, subject to the approval of the Administrator.

If, during calibration, the absolute temperatures measured with the gauge being calibrated and the reference gauge agree within 1.5 percent, the temperature data taken in the field shall be considered valid. Otherwise, the pollutant emission test shall either be considered invalid or adjustments (if appropriate) of the test results shall be made, subject to the approval of the Administrator.

4.4 Barometer. Calibrate the barometer used against a mercury barometer.

5. *Calculations*

Carry out calculations, retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after final calculation.

5.1 Nomenclature.

A = Cross-sectional area of stack, m² (ft²).

B_{ws} = Water vapor in the gas stream (from Method 5 or Reference Method 4), proportion by volume.

C_p = Pitot tube coefficient, dimensionless.

K_p = Pitot tube constant,

$$34.97\ \frac{\text{m}}{\text{sec}}\left[\frac{(g/g\text{-mole})(\text{mm Hg})}{(^\circ\text{K})(\text{mm H}_2\text{O})}\right]^{1/2}$$

for the metric system and

$$85.49\ \frac{\text{ft}}{\text{sec}}\left[\frac{(\text{lb/lb-mole})(\text{in. Hg})}{(^\circ\text{R})(\text{in. H}_2\text{O})}\right]^{1/2}$$

for the English system.

M_d = Molecular weight of stack gas, dry basis (see Section 3.6) g/g-mole (lb/lb-mole).

M_s = Molecular weight of stack gas, wet basis, g/g-mole (lb/lb-mole).

$$= M_d(1 - B_{ws}) + 18.0\,B_{ws} \qquad \text{Equation 2-5}$$

P_{bar} = Barometric pressure at measurement site, mm Hg (in. Hg).

P_g = Stack static pressure, mm Hg (in. Hg).

P_s = Absolute stack gas pressure, mm Hg (in. Hg).

$$= P_{bar} + P_g \qquad \text{Equation 2-6}$$

P_{std} = Standard absolute pressure, 760 mm Hg (29.92 in. Hg).

Q_{sd} = Dry volumetric stack gas flow rate corrected to standard conditions, dscm/hr (dscf/hr).

t_s = Stack temperature, °C (°F).

T_s = Absolute stack temperature, °K (°R).

$$= 273 + t_s \text{ for metric} \qquad \text{Equation 2-7}$$

$$= 460 + t_s \text{ for English} \qquad \text{Equation 2-8}$$

T_{std} = Standard absolute temperature, 293 °K (528° R)

v_s = Average stack gas velocity, m/sec (ft/sec).

Δp = Velocity head of stack gas, mm H_2O (in. H_2O).

3,600 = Conversion factor, sec/hr.

18.0 = Molecular weight of water, g/g-mole (lb-lb-mole).

5.2 Average stack gas velocity.

$$v_s = K_p C_p (\sqrt{\Delta p})_{avg} \sqrt{\frac{T_{s(avg)}}{P_s M_s}}$$

Equation 2-9

5.3 Average stack gas dry volumetric flow rate.

$$Q_{sd} = 3{,}600(1 - B_{ws})v_s A \left(\frac{T_{std}}{T_{s(avg)}}\right)\left(\frac{P_s}{P_{std}}\right)$$

Equation 2-10

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METHOD 3—GAS ANALYSIS FOR CARBON DIOXIDE, OXYGEN, EXCESS AIR, AND DRY MOLECULAR WEIGHT

1. *Principle and Applicability*

1.1 Principle. A gas sample is extracted from a stack, by one of the following methods: (1) single-point, grab sampling; (2) single-point, integrated sampling; or (3) multi-point, integrated sampling. The gas sample is analyzed for percent carbon dioxide (CO_2), percent oxygen (O_2), and, if necessary, percent carbon monoxide (CO). If a dry molecular weight determination is to be made, either an Orsat or a Fyrite[1] analyzer may be used for the analysis; for excess air or emission rate correction factor determination, an Orsat analyzer must be used.

1.2 Applicability. This method is applicable for determining CO_2 and O_2 concentrations, excess air, and dry molecular weight of a sample from a gas stream of a fossil-fuel combustion process. The method may also be applicable to other processes where it has been determined that compounds other than CO_2, O_2, CO, and nitrogen (N_2) are not present in concentrations sufficient to affect the results.

Other methods, as well as modifications to the procedure described herein, are also applicable for some or all of the above determinations. Examples of specific methods and modifications include: (1) a multi-point sampling method using an Orsat analyzer to analyze individual grab samples obtained at each point; (2) a method using CO_2 or O_2 and stoichiometric calculations to determine dry molecular weight and excess air; (3) assigning a value of 30.0 for dry molecular weight, in lieu of actual measurements, for processes burning natural gas, coal, or oil. These methods and modifications may be used, but are subject to the approval of the Administrator.

2. *Apparatus*

As an alternative to the sampling apparatus and systems described herein, other sampling systems (e.g., liquid displacement) may be used provided such systems are capable of obtaining a representative sample and maintaining a constant sampling rate, and are otherwise capable of yielding acceptable results. Use of such systems is subject to the approval of the Administrator.

2.1 Grab Sampling (Figure 3-1).

2.1.1 Probe. The probe should be made of stainless steel or borosilicate glass tubing and should be equipped with an in-stack or out-stack filter to remove particulate matter (a plug of glass wool is satisfactory for this purpose). Any other material inert to O_2, CO_2, CO, and N_2 and resistant to temperature at sampling conditions may be used for the probe; examples of such material are aluminum, copper, quartz glass and Teflon.

2.1.2 Pump. A one-way squeeze bulb, or equivalent, is used to transport the gas sample to the analyzer.

2.2 Integrated Sampling (Figure 3-2).

2.2.1 Probe. A probe such as that described in Section 2.1.1 is suitable.

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[1] Mention of trade names or specific products does not constitute endorsement by the Environmental Protection Agency.

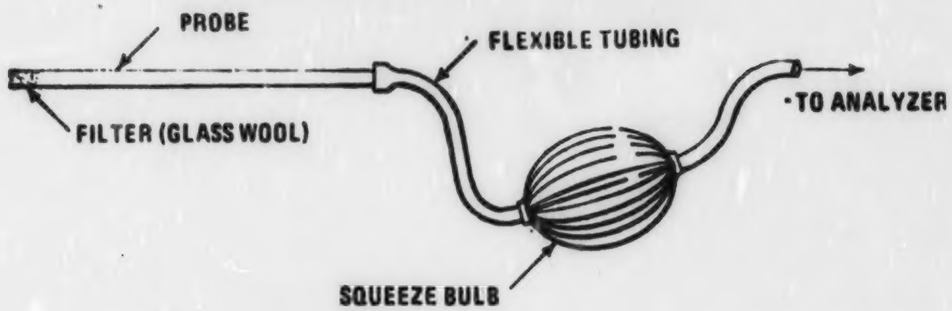
PROBE
FLEXIBLE TUBING
TO ANALYZER
FILTER (GLASS WOOL)
SQUEEZE BULB

Figure 3-1. Grab-sampling train.

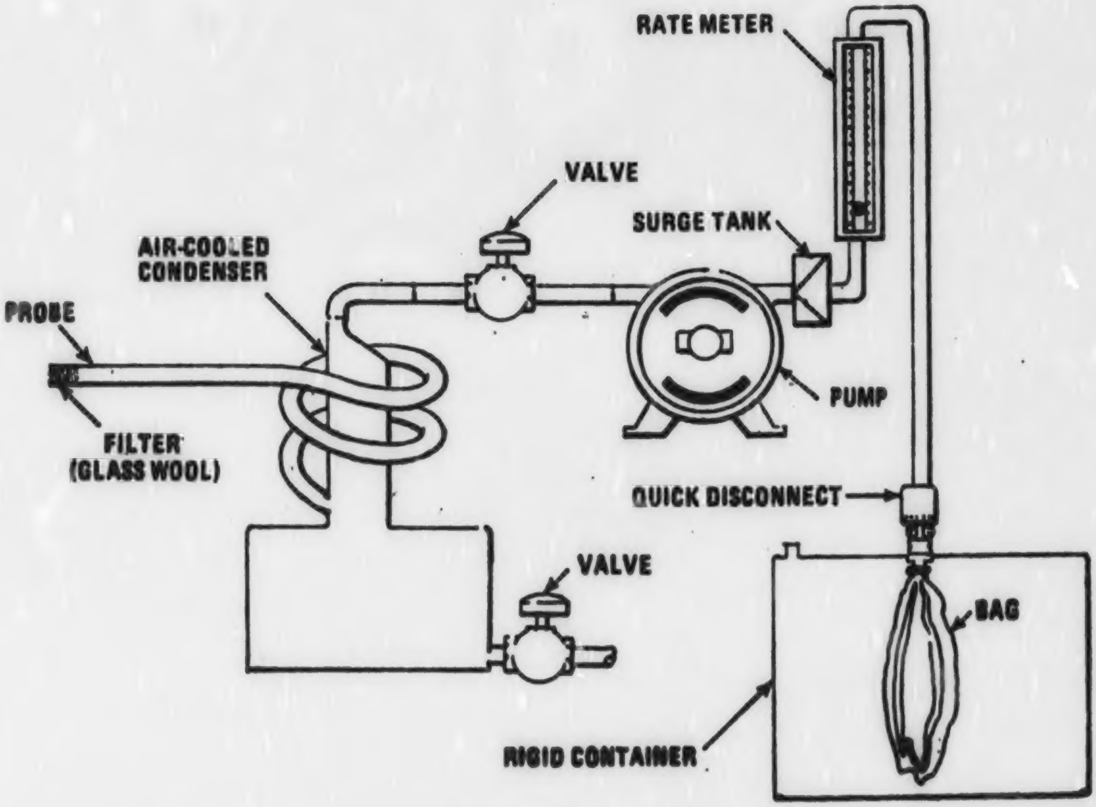
RATE METER
VALVE
SURGE TANK
AIR-COOLED CONDENSER
PROBE
PUMP
FILTER (GLASS WOOL)
QUICK DISCONNECT
VALVE
BAG
RIGID CONTAINER

Figure 3-2. Integrated gas-sampling train.

2.2.2 **Condenser.** An air-cooled or water-cooled condenser, or other condenser that will not remove O_2, CO_2, CO, and N_2, may be used to remove excess moisture which would interfere with the operation of the pump and flow meter.

2.2.3 **Valve.** A needle valve is used to adjust sample gas flow rate.

2.2.4 **Pump.** A leak-free, diaphragm-type pump, or equivalent, is used to transport sample gas to the flexible bag. Install a small surge tank between the pump and rate meter to eliminate the pulsation effect of the diaphragm pump on the rotameter.

2.2.5 **Rate Meter.** The rotameter, or equivalent rate meter, used should be capable of measuring flow rate to within ±2 percent of the selected flow rate. A flow rate range of 500 to 1000 cm³/min is suggested.

2.2.6 **Flexible Bag.** Any leak-free plastic (e.g., Tedlar, Mylar, Teflon) or plastic-coated aluminum (e.g., aluminized Mylar) bag, or equivalent, having a capacity consistent with the selected flow rate and time length of the test run, may be used. A capacity in the range of 55 to 90 liters is suggested.

To leak-check the bag, connect it to a water manometer and pressurize the bag to 5 to 10 cm H_2O (2 to 4 in. H_2O). Allow to stand for 10 minutes. Any displacement in the water manometer indicates a leak. An alternative leak-check method is to pressurize the bag to 5 to 10 cm H_2O (2 to 4 in. H_2O) and allow to stand overnight. A deflated bag indicates a leak.

2.2.7 **Pressure Gauge.** A water-filled U-tube manometer, or equivalent, of about 28 cm (12 in.) is used for the flexible bag leak-check.

2.2.8 **Vacuum Gauge.** A mercury manometer, or equivalent, of at least 760 mm Hg (30 in. Hg) is used for the sampling train leak-check.

2.3 **Analysis.** For Orsat and Fyrite analyzer maintenance and operation procedures, follow the instructions recommended by the manufacturer, unless otherwise specified herein.

2.3.1 **Dry Molecular Weight Determination.** An Orsat analyzer or Fyrite type combustion gas analyzer may be used.

2.3.2 **Emission Rate Correction Factor or Excess Air Determination.** An Orsat analyzer must be used. For low CO_2 (less than 4.0 percent) or high O_2 (greater than 15.0 percent) concentrations, the measuring burette of the Orsat must have at least 0.1 percent subdivisions.

3. *Dry Molecular Weight Determination*

Any of the three sampling and analytical procedures described below may be used for determining the dry molecular weight.

3.1 Single-Point, Grab Sampling and Analytical Procedure.

3.1.1 The sampling point in the duct shall either be at the centroid of the cross section or at a point no closer to the walls than 1.00 m (3.3 ft), unless otherwise specified by the Administrator.

3.1.2 Set up the equipment as shown in Figure 3-1, making sure all connections ahead of the analyzer are tight and leak-free. If an Orsat analyzer is used, it is recommended that the analyzer be leaked-checked by following the procedure in Section 5; however, the leak-check is optional.

3.1.3 Place the probe in the stack, with the tip of the probe positioned at the sampling point; purge the sampling line. Draw a sample into the analyzer and immediately analyze it for percent CO_2 and percent O_2. Determine the percentage of the gas that is N_2 and CO by subtracting the sum of the percent CO_2 and percent O_2 from 100 percent. Calculate the dry molecular weight as indicated in Section 6.3.

3.1.4 Repeat the sampling, analysis, and calculation procedures, until the dry molecular weights of any three grab samples differ from their mean by no more than 0.3 g/g-mole (0.3 lb/lb-mole). Average these three molecular weights, and report the results to the nearest 0.1 g/g-mole (lb/lb-mole).

3.2 Single-Point, Integrated Sampling and Analytical Procedure.

3.2.1 The sampling point in the duct shall be located as specified in Section 3.1.1.

3.2.2 Leak-check (optional) the flexible bag as in Section 2.2.6. Set up the equipment as shown in Figure 3-2. Just prior to sampling, leak-check (optional) the train by placing a vacuum gauge at the condenser inlet, pulling a vacuum of at least 250 mm Hg (10 in. Hg), plugging the outlet at the quick disconnect, and then turning off the pump. The vacuum should remain stable for at least 0.5 minute. Evacuate the flexible bag. Connect the probe and place it in the stack, with the tip of the probe positioned at the sampling point; purge the sampling line. Next, connect the bag and make sure that all connections are tight and leak free.

3.2.3 Sample at a constant rate. The sampling run should be simultaneous with, and for the same total length of time as, the pollutant emission rate determination. Collection of at least 30 liters (1.00 ft³) of sample gas is recommended; however, smaller volumes may be collected, if desired.

3.2.4 Obtain one integrated flue gas sample during each pollutant emission rate determination. Within 8 hours after the sample is taken, analyze it for percent CO_2 and percent O_2 using either an Orsat analyzer or a Fyrite-type combustion gas analyzer. If an Orsat analyzer is used, it is recommended that the Orsat leak-check described in Section 5 be performed before this determination; however, the check is optional. Determine the percentage of the gas that is N_2 and CO by subtracting the sum of the percent CO_2 and percent O_2 from 100 percent. Calculate the dry molecular weight as indicated in Section 6.3.

3.2.5 Repeat the analysis and calculation procedures until the individual dry molecular weights for any three analyses differ from their mean by no more than 0.3 g/g-mole (0.3 lb/lb-mole). Average these three molecular weights, and report the results to the nearest 0.1 g/g-mole (0.1 lb/lb-mole).

3.3 Multi-Point, Integrated Sampling and Analytical Procedure.

3.3.1 Unless otherwise specified by the Administrator, a minimum of eight traverse points shall be used for circular stacks having diameters less then 0.61 m (24 in.), a minimum of nine shall be used for rectangular stacks having equivalent diameters less than 0.61 m (24 in.), and a minimum of twelve traverse points shall be used for all other cases. The traverse points shall be located according to Method 1. The use of fewer points is subject to approval of the Administrator.

3.3.2 Follow the procedures outlined in Sections 3.2.2 through 3.2.5, except for the following: traverse all sampling points and sample at each point for an equal length of time. Record sampling data as shown in Figure 3-3.

4. *Emission Rate Correction Factor or Excess Air Determination*

NOTE.—A Fyrite-type combustion gas analyzer is not acceptable for excess air or emission rate correction factor determination, unless approved by the Administrator. If both percent CO_2 and percent O_2 are measured, the analytical results of any of the three procedures given below may also be used for calculating the dry molecular weight.

Each of the three procedures below shall be used only when specified in an applicable subpart of the standards. The use of these procedures for other purposes must have specific prior approval of the Administrator.

4.1 Single-Point, Grab Sampling and Analytical Procedure.

4.1.1 The sampling point in the duct shall either be at the centroid of the cross-section or at a point no closer to the walls than 1.00 m (3.3 ft), unless otherwise specified by the Administrator.

4.1.2 Set up the equipment as shown in Figure 3-1, making sure all connections ahead of the analyzer are tight and leak-free. Leak-check the Orsat analyzer according to the procedure described in Section 5. This leak-check is mandatory.

TIME	TRAVERSE PT.	Q 1pm	% DEV.[a]
	AVERAGE		

$$^{a}\% \text{ DEV} = \left(\frac{Q - Q_{avg}}{Q_{avg}}\right) 100 \qquad (\text{MUST BE} \leq 10\%)$$

Figure 3-3. Sampling rate data.

4.1.3 Place the probe in the stack, with the tip of the probe positioned at the sampling point; purge the sampling line. Draw a sample into the analyzer. For emission rate correction factor determination, immediately analyze the sample, as outlined in Sections 4.1.4 and 4.1.5, for percent CO_2 or percent O_2. If excess air is desired, proceed as follows: (1) immediately analyze the sample, as in Sections 4.1.4 and 4.1.5, for percent CO_2, O_2, and CO; (2) determine the percentage of the gas that is N_2 by subtracting the sum of the percent CO_2, percent O_2, and percent CO from 100 percent; and (3) calculate percent excess air as outlined in Section 6.2.

4.1.4 To ensure complete absorption of the CO_2, O_2, or if applicable, CO, make repeated passes through each absorbing solution until two consecutive readings are the same. Several passes (three or four) should be made between readings. (If constant readings cannot be obtained after three consecutive readings, replace the absorbing solution.)

4.1.5 After the analysis is completed, leak-check (mandatory) the Orsat analyzer once again, as described in Section 5. For the results of the analysis to be valid, the Orsat analyzer must pass this leak test before and after the analysis. NOTE.—Since this single-point, grab sampling and analytical procedure is normally conducted in conjunction with a single-point, grab sampling and analytical procedure for a pollutant, only one analysis is ordinarily conducted. Therefore, great care must be taken to obtain a valid sample and analysis. Although in most cases only CO_2 or O_2 is required, it is recommended that both CO_2 and O_2 be measured, and that Citation 5 in the Bibliography be used to validate the analytical data.

4.2 Single-Point, Integrated Sampling and Analytical Procedure.

4.2.1 The sampling point in the duct shall be located as specified in Section 4.1.1.

4.2.2 Leak-check (mandatory) the flexible bag as in Section 2.2.6. Set up the equipment as shown in Figure 3-2. Just prior to sampling, leak-check (mandatory) the train by placing a vacuum gauge at the condenser inlet, pulling a vacuum of at least 250 mm Hg (10 in. Hg), plugging the outlet at the quick disconnect, and then turning off the pump. The vacuum shall remain stable for at least 0.5 minute. Evacuate the flexible bag. Connect the probe and place it in the stack, with the tip of the probe positioned at the sampling point; purge the sampling line. Next, connect the bag and make sure that all connections are tight and leak free.

4.2.3 Sample at a constant rate, or as specified by the Administrator. The sampling run must be simultaneous with, and for the same total length of time as, the pollutant emission rate determination. Collect at least 30 liters (1.00 ft³) of sample gas. Smaller volumes may be collected, subject to approval of the Administrator.

4.2.4 Obtain one integrated flue gas sample during each pollutant emission rate determination. For emission rate correction factor determination, analyze the sample within 4 hours after it is taken for percent CO_2 or percent O_2 (as outlined in Sections 4.2.5 through 4.2.7). The Orsat analyzer must be leak-checked (see Section 5) before the analysis. If excess air is desired, proceed as follows: (1) within 4 hours after the sample is taken, analyze it (as in Sections 4.2.5 through 4.2.7) for percent CO_2, O_2, and CO; (2) determine the percentage of the gas that is N_2 by subtracting the sum of the percent CO_2, percent O_2, and percent CO from 100 percent; (3) calculate percent excess air, as outlined in Section 6.2.

4.2.5 To ensure complete absorption of the CO_2, O_2, or if applicable, CO, make repeated passes through each absorbing solution until two consecutive readings are the same. Several passes (three or four) should be made between readings. (If constant readings cannot be obtained after three consecutive readings, replace the absorbing solution.)

4.2.6 Repeat the analysis until the following criteria are met:

4.2.6.1 For percent CO_2, repeat the analytical procedure until the results of any three analyses differ by no more than (a) 0.3 percent by volume when CO_2 is greater than 4.0 percent or (b) 0.2 percent by volume when CO_2 is less than or equal to 4.0 percent. Average the three acceptable values of percent CO_2 and report the results to the nearest 0.1 percent.

4.2.6.2 For percent O_2, repeat the analytical procedure until the results of any three analyses differ by no more than (a) 0.3 percent by volume when O_2 is less than 15.0 percent or (b) 0.2 percent by volume when O_2 is greater than 15.0 percent. Average the three acceptable values of percent O_2 and report the results to the nearest 0.1 percent.

4.2.6.3 For percent CO, repeat the analytical procedure until the results of any three analyses differ by no more than 0.3 percent. Average the three acceptable values of percent CO and report the results to the nearest 0.1 percent.

4.2.7 After the analysis is completed, leak-check (mandatory) the Orsat analyzer once again, as described in Section 5. For the results of the analysis to be valid, the Orsat analyzer must pass this leak test before and after the analysis. Note: Although in most instances only CO_2 or O_2 is required, it is recommended that both CO_2 and O_2 be measured, and that Citation 5 in the Bibliography be used to validate the analytical data.

4.3 Multi-Point, Integrated Sampling and Analytical Procedure.

4.3.1 Both the minimum number of sampling points and the sampling point location shall be as specified in Section 3.3.1 of this method. The use of fewer points than specified is subject to the approval of the Administrator.

4.3.2 Follow the procedures outlined in Sections 4.2.3 through 4.2.7, except for the following: Traverse all sampling points and sample at each point for an equal length of time. Record sampling data as shown in Figure 3-3.

5. *Leak-Check Procedure for Orsat Analyzers*

Moving an Orsat analyzer frequently causes it to leak. Therefore, an Orsat analyzer should be thoroughly leak-checked on site before the flue gas sample is introduced into it. The procedure for leak-checking an Orsat analyzer is:

5.1.1 Bring the liquid level in each pipette up to the reference mark on the capillary tubing and then close the pipette stopcock.

5.1.2 Raise the leveling bulb sufficiently to bring the confining liquid meniscus onto the graduated portion of the burette and then close the manifold stopcock.

5.1.3 Record the meniscus position.

5.1.4 Observe the meniscus in the burette and the liquid level in the pipette for movement over the next 4 minutes.

5.1.5 For the Orsat analyzer to pass the leak-check, two conditions must be met.

5.1.5.1 The liquid level in each pipette must not fall below the bottom of the capillary tubing during this 4-minute interval.

5.1.5.2 The meniscus in the burette must not change by more than 0.2 ml during this 4-minute interval.

5.1.6 If the analyzer fails the leak-check procedure, all rubber connections and stopcocks should be checked until the cause of the leak is identified. Leaking stopcocks must be disassembled, cleaned, and regreased. Leaking rubber connections must be replaced. After the analyzer is reassembled, the leak-check procedure must be repeated.

6. *Calculations*

6.1 Nomenclature.

M_d = Dry molecular weight, g/g-mole (lb/lb-mole).
%EA = Percent excess air.
$\%CO_2$ = Percent CO_2 by volume (dry basis).
$\%O_2$ = Percent O_2 by volume (dry basis).
%CO = Percent CO by volume (dry basis).
$\%N_2$ = Percent N_2 by volume (dry basis).
0.264 = Ratio of O_2 to N_2 in air, v/v.
0.280 = Molecular weight of N_2 or CO, divided by 100.
0.320 = Molecular weight of O_2 divided by 100.
0.440 = Molecular weight of CO_2 divided by 100.

6.2 Percent Excess Air. Calculate the percent excess air (if applicable), by substituting the appropriate values of percent O_2, CO, and N_2 (obtained from Section 4.1.3 or 4.2.4) into Equation 3-1.

$$\%EA = \left[\frac{\%O_2 - 0.5\%CO}{0.264\,\%N_2\,(\%O_2 - 0.5\,\%CO)}\right]100$$

Equation 3-1

NOTE.—The equation above assumes that ambient air is used as the source of O_2 and that the fuel does not contain appreciable amounts of N_2 (as do coke oven or blast furnace gases). For those cases when appreciable amounts of N_2 are present (coal, oil, and natural gas do not contain appreciable amounts of N_2) or when oxygen enrichment is used, alternate methods, subject to approval of the Administrator, are required.

6.3 Dry Molecular Weight. Use Equation 3-2 to calculate the dry molecular weight of the stack gas

$$M_d = 0.440(\%CO_2) + 0.320(\%O_2) + 0.280(\%N_2 + \%CO)$$

Equation 3-2

NOTE.—The above equation does not consider argon in air (about 0.9 percent, molecular weight of 37.7). A negative error of about 0.4 percent is introduced. The tester may opt to include argon in the analysis using procedures subject to approval of the Administrator.

7. *Bibliography*

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METHOD 4—DETERMINATION OF MOISTURE CONTENT IN STACK GASES

1. *Principle and Applicability*

1.1 Principle. A gas sample is extracted at a constant rate from the source; moisture is removed from the sample stream and determined either volumetrically or gravimetrically.

1.2 Applicability. This method is applicable for determining the moisture content of stack gas.

Two procedures are given. The first is a reference method, for accurate determinations of moisture content (such as are needed to calculate emission data). The second is an approximation method, which provides estimates of percent moisture to aid in setting isokinetic sampling rates prior to a pollutant emission measurement run. The approximation method described herein is only a suggested approach; alternative means for approximating the moisture content, e.g., drying tubes, wet bulb-dry bulb techniques, condensation techniques, stoichiometric calculations, previous experience, etc., are also acceptable.

The reference method is often conducted simultaneously with a pollutant emission measurement run; when it is, calculation of percent isokinetic, pollutant emission rate, etc., for the run shall be based upon the results of the reference method or its equivalent; these calculations shall not be based upon the results of the approximation method, unless the approximation method is shown, to the satisfaction of the Administrator, U.S. Environmental Protection Agency, to be capable of yielding results within 1 percent H_2O of the reference method.

NOTE.—The reference method may yield questionable results when applied to saturated gas streams or to streams that contain water droplets. Therefore, when these conditions exist or are suspected, a second determination of the moisture content shall be made simultaneously with the reference method, as follows: Assume that the gas stream is saturated. Attach a temperature sensor [capable of measuring to ±1° C (2° F)] to the reference method probe. Measure the stack gas temperature at each traverse point (see Section 2.2.1) during the reference method traverse; calculate the average stack gas temperature. Next, determine the moisture percentage, either by: (1) using a psychrometric chart and making appropriate corrections if stack pressure is different from that of the chart, or (2) using saturation vapor pressure tables. In cases where the psychrometric chart or the saturation vapor pressure tables are not applicable (based on evaluation of the process), alternate methods, subject to the approval of the Administrator, shall be used.

2. *Reference Method*

The procedure described in Method 5 for determining moisture content is acceptable as a reference method.

2.1 Apparatus. A schematic of the sampling train used in this reference method is shown in Figure 4-1. All components shall be maintained and calibrated according to the procedure outlined in Method 5.

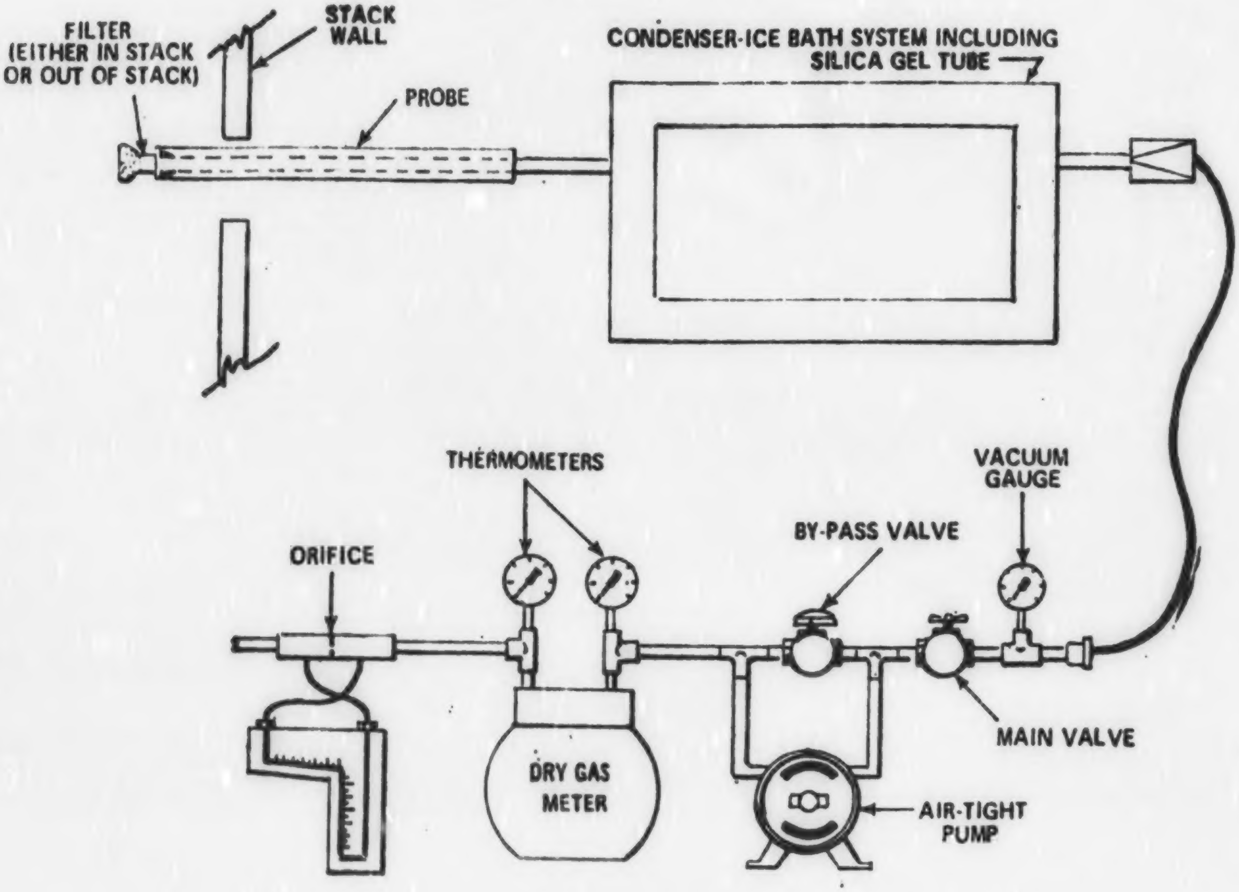

Figure 4-1. Moisture sampling train-reference method.

2.1.1 Probe. The probe is constructed of stainless steel or glass tubing, sufficiently heated to prevent water condensation, and is equipped with a filter, either in-stack (e.g., a plug of glass wool inserted into the end of the probe) or heated out-stack (e.g., as described in Method 5), to remove particulate matter.

When stack conditions permit, other metals or plastic tubing may be used for the probe, subject to the approval of the Administrator.

2.1.2 Condenser. The condenser consists of four impingers connected in series with ground glass, leak-free fittings or any similarly leak-free non-contaminating fittings. The first, third, and fourth impingers shall be of the Greenburg-Smith design, modified by replacing the tip with a 1.3 centimeter (½ inch) ID glass tube extending to about 1.3 cm (½ in.) from the bottom of the flask. The second impinger shall be of the Greenburg-Smith design with the standard tip. Modifications (e.g., using flexible connections between the impingers, using materials other than glass, or using flexible vacuum lines to connect the filter holder to the condenser) may be used, subject to the approval of the Administrator.

The first two impingers shall contain known volumes of water, the third shall be empty, and the fourth shall contain a known weight of 6- to 16-mesh indicating type silica gel, or equivalent desiccant. If the silica gel has been previously used, dry at 175° C (350° F) for 2 hours. New silica gel may be used as received. A thermometer, capable of measuring temperature to within 1° C (2° F), shall be placed at the outlet of the fourth impinger, for monitoring purposes.

Alternatively, any system may be used (subject to the approval of the Administrator) that cools the sample gas stream and allows measurement of both the water that has been condensed and the moisture leaving the condenser, each to within 1 ml or 1 g. Acceptable means are to measure the condensed water, either gravimetrically or volumetrically, and to measure the moisture leaving the condenser by: (1) monitoring the temperature and pressure at the exit of the condenser and using Dalton's law of partial pressures, or (2) passing the sample gas stream through a tared silica gel (or equivalent desiccant) trap, with exit gases kept below 20° C (68° F), and determining the weight gain.

If means other than silica gel are used to determine the amount of moisture leaving the condenser, it is recommended that silica gel (or equivalent) still be used between the condenser system and pump, to prevent moisture condensation in the pump and metering devices and to avoid the need to make corrections for moisture in the metered volume.

2.1.3 Cooling System. An ice bath container and crushed ice (or equivalent) are used to aid in condensing moisture.

2.1.4 Metering System. This system includes a vacuum gauge, leak-free pump, thermometers capable of measuring temperature to within 3° C (5.4° F), dry gas meter capable of measuring volume to within 2 percent, and related equipment as shown in Figure 4-1. Other metering systems, capable of maintaining a constant sampling rate and determining sample gas volume, may be used, subject to the approval of the Administrator.

2.1.5 Barometer. Mercury, aneroid, or other barometer capable of measuring atmospheric pressure to within 2.5 mm Hg (0.1 in. Hg) may be used. In many cases, the barometric reading may be obtained from a nearby national weather service station, in which case the station value (which is the absolute barometric pressure) shall be requested and an adjustment for elevation differences between the weather station and the sampling point shall be applied at a rate of minus 2.5 mm Hg (0.1 in. Hg) per 30 m (100 ft) elevation increase or vice versa for elevation decrease.

2.1.6 Graduated Cylinder and/or Balance. These items are used to measure condensed water and moisture caught in the silica gel to within 1 ml or 0.5 g. Graduated cylinders shall have subdivisions no greater than 2 ml. Most laboratory balances are capable of weighing to the nearest 0.5 g or less. These balances are suitable for use here.

2.2 Procedure. The following procedure is written for a condenser system (such as the impinger system described in Section 2.1.2) incorporating volumetric analysis to measure the condensed moisture, and silica gel and gravimetric analysis to measure the moisture leaving the condenser.

2.2.1 Unless otherwise specified by the Administrator, a minimum of eight traverse points shall be used for circular stacks having diameters less than 0.61 m (24 in.), a minimum of nine points shall be used for rectangular stacks having equivalent diameters less than 0.61 m (24 in.), and a minimum of twelve travers points shall be used in all other cases. The traverse points shall be located according to Method 1. The use of fewer points is subject to the approval of the Administrator. Select a suitable probe and probe length such that all traverse points can be sampled. Consider sampling from opposite sides of the stack (four total sampling ports) for large stacks, to permit use of shorter probe lengths. Mark the probe with heat resistant tape or by some other method to denote the proper distance into the stack or duct for each sampling point. Place known volumes of water in the first two impingers. Weigh and record the weight of the silica gel to the nearest 0.5 g, and transfer the silica gel to the fourth impinger; alternatively, the silica gel may first be transferred to the impinger, and the weight of the silica gel plus impinger recorded.

2.2.2 Select a total sampling time such that a minimum total gas volume of 0.60 scm (21 scf) will be collected, at a rate no greater than 0.021 m^3/min (0.75 cfm). When both moisture content and pollutant emission rate are to be determined, the moisture determination shall be simultaneous with, and for the same total length of time as, the pollutant emission rate run, unless otherwise specified in an applicable subpart of the standards.

2.2.3 Set up the sampling train as shown in Figure 4-1. Turn on the probe heater and (if applicable) the filter heating system to temperatures of about 120° C (248° F), to prevent water condensation ahead of the condenser; allow time for the temperatures to stabilize. Place crushed ice in the ice bath container. It is recommended, but not required, that a leak check be done, as follows: Disconnect the probe from the first impinger or (if applicable) from the filter holder. Plug the inlet to the first impinger (or filter holder) and pull a 380 mm (15 in.) Hg vacuum, a lower vacuum may be used, provided that it is not exceeded during the test. A leakage rate in excess of 4 percent of the average sampling rate or 0.00057 m³/min (0.02 cfm), whichever is less, is unacceptable. Following the leak check, reconnect the probe to the sampling train.

2.2.4 During the sampling run, maintain a sampling rate within 10 percent of constant rate, or as specified by the Administrator. For each run, record the data required on the example data sheet shown in Figure 4-2. Be sure to record the dry gas meter reading at the beginning and end of each sampling time increment and whenever sampling is halted. Take other appropriate readings at each sample point, at least once during each time increment.

2.2.5 To begin sampling, position the probe tip at the first traverse point. Immediately start the pump and adjust the flow to the desired rate. Traverse the cross section, sampling at each traverse point for an equal length of time. Add more ice and, if necessary, salt to maintain a temperature of less than 20° C (68° F) at the silica gel outlet.

2.2.6 After collecting the sample, disconnect the probe from the filter holder (or from the first impinger) and conduct a leak check (mandatory) as described in Section 2.2.3. Record the leak rate. If the leakage rate exceeds the allowable rate, the tester shall either reject the test results or shall correct the sample volume as in Section 6.3 of Method 5. Next, measure the volume of the moisture condensed to the nearest ml. Determine the increase in weight of the silica gel (or silica gel plus impinger) to the nearest 0.5 g. Record this information (see example data sheet, Figure 4-3) and calculate the moisture percentage, as described in 2.3 below.

2.3 Calculations. Carry out the following calculations, retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after final calculation.

PLANT____________________

LOCATION____________________

OPERATOR____________________

DATE____________________

RUN NO.____________________

AMBIENT TEMPERATURE____________________

BAROMETRIC PRESSURE____________________

PROBE LENGTH m(ft)____________________

SCHEMATIC OF STACK CROSS SECTION

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min.	STACK TEMPERATURE °C (°F)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH), mm(in.) H_2O	METER READING GAS SAMPLE VOLUME m^3 (ft^3)	ΔV_m m^3 (ft^3)	GAS SAMPLE TEMPERATURE AT DRY GAS METER		TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER, °C (°F)
						INLET ($T_{m_{in}}$), °C (°F)	OUTLET ($T_{m_{out}}$), °C (°F)	
TOTAL						Avg.	Avg.	
AVERAGE						Avg.		

Figure 4-2. Field moisture determination-reference method.

	IMPINGER VOLUME, ml	SILICA GEL WEIGHT, g
FINAL		
INITIAL		
DIFFERENCE		

Figure 4-3. Analytical data - reference method.

2.3.1 Nomenclature.

B_{ws} = Proportion of water vapor, by volume, in the gas stream.

M_w = Molecular weight of water, 18.0 g/g-mole (18.0 lb/lb-mole).

P_m = Absolute pressure (for this method, same as barometric pressure) at the dry gas meter, mm Hg (in. Hg).

P_{std} = Standard absolute pressure, 760 mm Hg (29.92 in. Hg).

R = Ideal gas constant, 0.06236 (mm Hg) (m^3)/(g-mole) (°K) for metric units and 21.85 (in. Hg) (ft^3)/(lb-mole) (°R) for English units.

T_m = Absolute temperature at meter, °K (°R).

T_{std} = Standard absolute temperature, 293° K (528° R).

V_m = Dry gas volume measured by dry gas meter, dcm (dcf).

ΔV_m = Incremental dry gas volume measured by dry gas meter at each traverse point, dcm (dcf).

$V_{m(std)}$ = Dry gas volume measured by the dry gas meter, corrected to standard conditions, dscm (dscf).

$V_{wc(std)}$ = Volume of water vapor condensed corrected to standard conditions, scm (scf).

$V_{wsg(std)}$ = Volume of water vapor collected in silica gel corrected to standard conditions, scm (scf).

V_f = Final volume of condenser water, ml.

V_i = Initial volume, if any, of condenser water, ml.

W_f = Final weight of silica gel or silica gel plus impinger, g.

W_i = Initial weight of silica gel or silica gel plus impinger, g.

Y = Dry gas meter calibration factor.

ρ_w = Density of water, 0.9982 g/ml (0.002201 lb/ml).

2.3.2 Volume of water vapor condensed.

$$V_{wc(std)} = \frac{(V_f - V_i)\rho_w R T_{std}}{P_{std} M_w} = K_1(V_f - V_i)$$

Equation 4-1

where:

K_1 = 0.001333 m^3/ml for metric units

= 0.04707 ft^3/ml for English units

2.3.3 Volume of water vapor collected in silica gel.

$$V_{wsg(std)} = \frac{(W_f - W_i) R T_{std}}{P_{std} M_w} = K_2(W_f - W_i)$$

Equation 4-2

where:

K_2 = 0.001335 m^3/g for metric units

= 0.04715 ft^3/g for English units

2.3.4 Sample gas volume.

$$V_{m(std)} = V_m Y \frac{(P_m)(T_{std})}{(P_{std})(T_m)} = K_3 Y \frac{V_m P_m}{T_m}$$

Equation 4-3

where:

K_3 = 0.3858 °K/mm Hg for metric units

= 17.64 °R/in. Hg for English units

NOTE.—If the post-test leak rate (Section 2.2.6) exceeds the allowable rate, correct the value of V_m in Equation 4-3, as described in Section 6.3 of Method 5.

2.3.5 Moisture Content

$$B_{ws} = \frac{V_{wc(std)} + V_{wsg(std)}}{V_{wc(std)} + V_{wsg(std)} + V_{m(std)}}$$

Equation 4-4

NOTE.—In saturated or moisture droplet-laden gas streams, two calculations of the moisture content of the stack gas shall be made, one using a value based upon the saturated conditions (see Section 1.2), and another based upon the results of the impinger analysis. The lower of these two values of B_{ws} shall be considered correct.

2.3.6 Verification of constant sampling rate. For each time increment, determine the ΔV_m. Calculate the average. If the value for any time increment differs from the average by more than 10 percent, reject the results and repeat the run.

3. *Approximation Method*

The approximation method described below is presented only as a suggested method (see Section 1.2).

3.1 Apparatus.

3.1.1 Probe. Stainless steel or glass tubing, sufficiently heated to prevent water condensation and equipped with a filter (either in-stack or heated out-stack) to remove particulate matter. A plug of glass wool, inserted into the end of the probe, is a satisfactory filter.

3.1.2 Impingers. Two midget impingers, each with 30 ml capacity, or equivalent.

3.1.3 Ice Bath. Container and ice, to aid in condensing moisture in impingers.

3.1.4 Drying Tube. Tube packed with new or regenerated 6- to 16-mesh indicating-type silica gel (or equivalent desiccant), to dry the sample gas and to protect the meter and pump.

3.1.5 Valve. Needle valve, to regulate the sample gas flow rate.

3.1.6 Pump. Leak-free, diaphragm type, or equivalent, to pull the gas sample through the train.

3.1.7 Volume meter. Dry gas meter, sufficiently accurate to measure the sample volume within 2%, and calibrated over the range of flow rates and conditions actually encountered during sampling.

3.1.8 Rate Meter. Rotameter, to measure the flow range from 0 to 3 lpm (0 to 0.11 cfm).

3.1.9 Graduated Cylinder. 25 ml.

3.1.10 Barometer. Mercury, aneroid, or other barometer, as described in Section 2.1.5 above.

3.1.11 Vacuum Gauge. At least 760 mm Hg (30 in. Hg) gauge, to be used for the sampling leak check.

3.2 Procedure.

3.2.1 Place exactly 5 ml distilled water in each impinger. Assemble the apparatus without the probe as shown in Figure 4-4. Leak check the train by placing a vacuum gauge at the inlet to the first impinger and drawing a vacuum of at least 250 mm Hg (10 in. Hg), plugging the outlet of the rotameter, and then turning off the pump. The vacuum shall remain constant for at least one minute. Carefully release the vacuum gauge before unplugging the rotameter end.

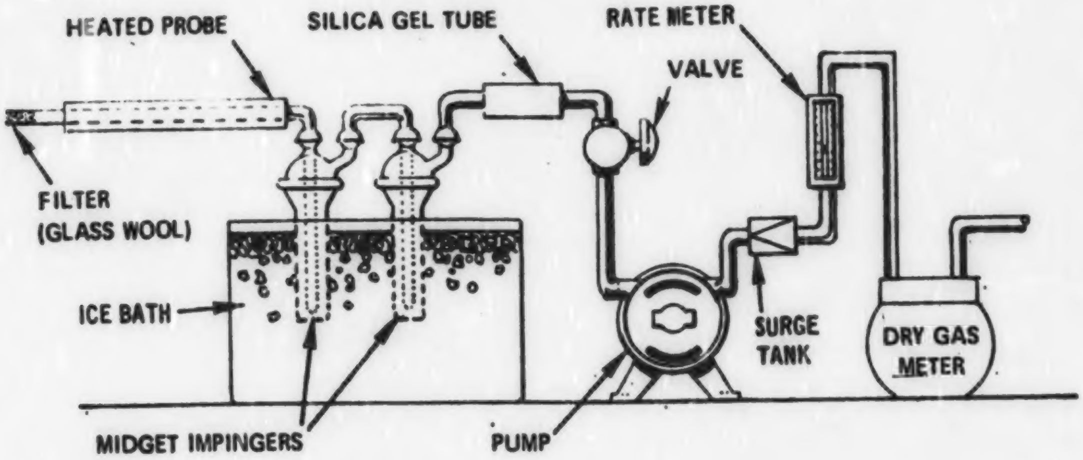
HEATED PROBE
SILICA GEL TUBE
RATE METER
VALVE
FILTER (GLASS WOOL)
ICE BATH
SURGE TANK
DRY GAS METER
MIDGET IMPINGERS
PUMP

Figure 4-4. Moisture sampling train - approximation method.

LOCATION ______________________________ COMMENTS

TEST ______________________________

DATE ______________________________

OPERATOR ______________________________

BAROMETRIC PRESSURE ______________________

CLOCK TIME	GAS VOLUME THROUGH METER, (Vm), m^3 (ft^3)	RATE METER SETTING m^3/min. (ft^3/min.)	METER TEMPERATURE, °C (°F)

Figure 4-5. Field moisture determination - approximation method.

3.2.2 Connect the probe, insert it into the stack, and sample at a constant rate of 2 lpm (0.071 cfm). Continue sampling until the dry gas meter registers about 30 liters (1.1 ft³) or until visible liquid droplets are carried over from the first impinger to the second. Record temperature, pressure, and dry gas meter readings as required by Figure 4-5.

3.2.3 After collecting the sample, combine the contents of the two impingers and measure the volume to the nearest 0.5 ml.

3.3 Calculations. The calculation method presented is designed to estimate the moisture in the stack gas; therefore, other data, which are only necessary for accurate moisture determinations, are not collected. The following equations adequately estimate the moisture content, for the purpose of determining isokinetic sampling rate settings.

3.3.1 Nomenclature.

B_{wm} = Approximate proportion, by volume, of water vapor in the gas stream leaving the second impinger, 0.025.

B_{ws} = Water vapor in the gas stream, proportion by volume.

M_w = Molecular weight of water, 18.0 g/g-mole (18.0 lb/lb-mole)

P_m = Absolute pressure (for this method, same as barometric pressure) at the dry gas meter.

P_{std} = Standard absolute pressure, 760 mm Hg (29.92 in. Hg).

R = Ideal gas constant, 0.06236 (mm Hg) (m³)/(g-mole) (°K) for metric units and 21.85 (in. Hg) (ft³)/lb-mole) (°R) for English units.

T_m = Absolute temperature at meter, °K (°R)

T_{std} = Standard absolute temperature, 293° K (528° R)

V_f = Final volume of impinger contents, ml.

V_i = Initial volume of impinger contents, ml.

V_m = Dry gas volume measured by dry gas meter, dcm (dcf).

$V_{m(std)}$ = Dry gas volume measured by dry gas meter, corrected to standard conditions, dscm (dscf).

$V_{wc(std)}$ = Volume of water vapor condensed, corrected to standard conditions, scm (scf).

ρ_w = Density of water, 0.9982 g/ml (0.002201 lb/ml).

3.3.2 Volume of water vapor collected.

$$V_{wc} = \frac{(V_f - V_i)\rho_w R T_{std}}{P_{std} M_w} = K_1 (V_f - V_i)$$

Equation 4-5

where:
K_1 = 0.001333 m³/ml for metric units
= 0.04707 ft³/ml for English units.

3.3.3 Gas volume.

$$V_{m(std)} = V_m\left(\frac{P_m}{P_{std}}\right)\left(\frac{T_{std}}{T_m}\right) = K_2 \frac{V_m P_m}{T_m}$$

Equation 4-6

where:
K_2 = 0.3858 °K/mm Hg for metric units
= 17.64 °R/in. Hg for English units

3.3.4 Approximate moisture content.

$$B_{ws} = \frac{V_{wc}}{V_{wc} + V_{m(std)}} + B_{wm} = \frac{V_{wc}}{V_{wc} + V_{m(std)}} + (0.025)$$

Equation 4-7

4. *Calibration*

4.1 For the reference method, calibrate equipment as specified in the following sections of Method 5: Section 5.3 (metering system); Section 5.5 (temperature gauges); and Section 5.7 (barometer). The recommended leak check of the metering system (Section 5.6 of Method 5) also applies to the reference method. For the approximation method, use the procedures outlined in Section 5.1.1 of Method 6 to calibrate the metering system, and the procedure of Method 5, Section 5.7 to calibrate the barometer.

5. *Bibliography*

1. Air Pollution Engineering Manual (Second Edition). Danielson, J. A. (ed.). U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, N.C. Publication No. AP-40. 1973.

2. Devorkin, Howard, et al. Air Pollution Source Testing Manual. Air Pollution Control District, Los Angeles, Calif. November, 1963.

3. Methods for Determination of Velocity, Volume, Dust and Mist Content of Gases. Western Precipitation Division of Joy Manufacturing Co., Los Angeles, Calif. Bulletin WP-50. 1968.

METHOD 5—DETERMINATION OF PARTICULATE EMISSIONS FROM STATIONARY SOURCES

1. *Principle and Applicability*

1.1 Principle. Particulate matter is withdrawn isokinetically from the source and collected on a glass fiber filter maintained at a temperature in the range of 120±14° C (248±25° F) or such other temperature as specified by an applicable subpart of the standards or approved by the Administrator, U.S. Environmental Protection Agency, for a particular application. The particulate mass, which includes any material that condenses at or above the filtration temperature, is determined gravimetrically after removal of uncombined water.

1.2 Applicability. This method is applicable for the determination of particulate emissions from stationary sources.

2. *Apparatus*

2.1 Sampling Train. A schematic of the sampling train used in this method is shown in Figure 5-1. Complete construction details are given in APTD-0581 (Citation 2 in Section 7); commercial models of this train are also available. For changes from APTD-0581 and for allowable modifications of the train shown in Figure 5-1, see the following subsections.

The operating and maintenance procedures for the sampling train are described in APTD-0576 (Citation 3 in Section 7). Since correct usage is important in obtaining valid results, all users should read APTD-0576 and adopt the operating and maintenance procedures outlined in it, unless otherwise specified herein. The sampling train consists of the following components:

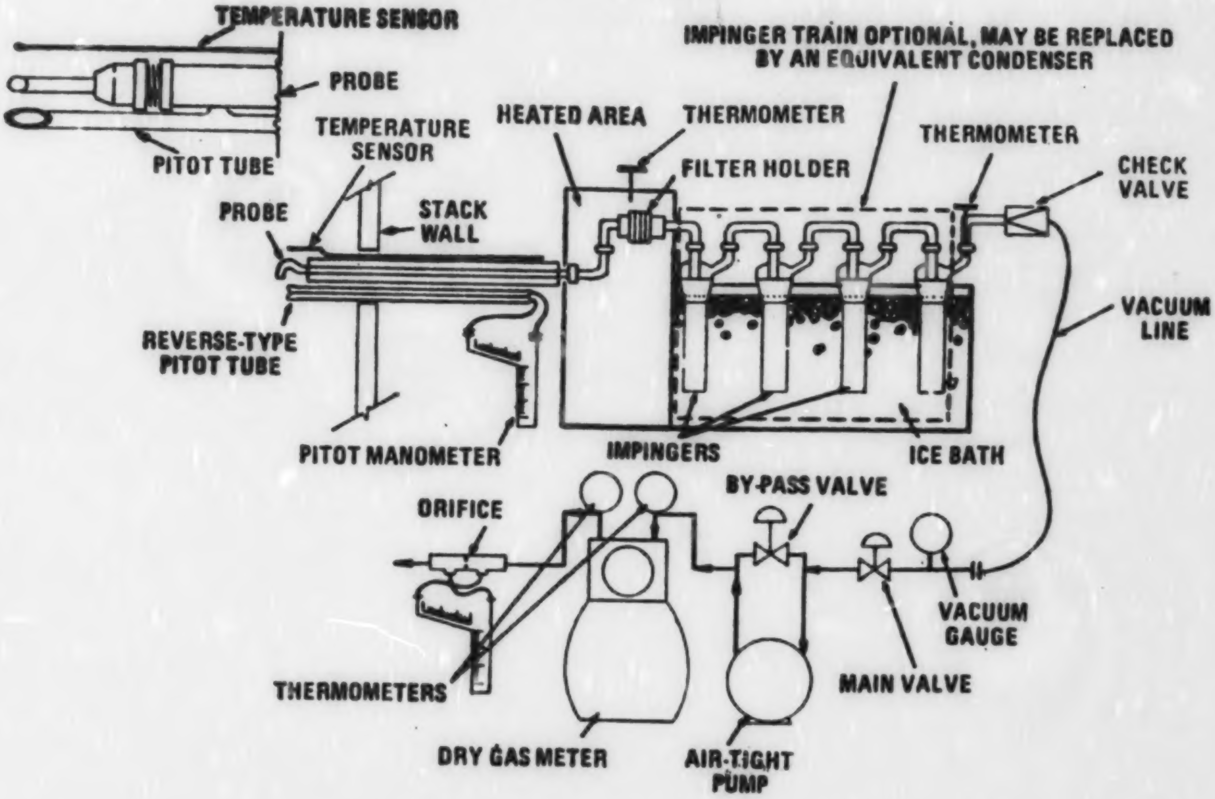

Figure 5 1. Particulate-sampling train.

2.1.1 Probe Nozzle. Stainless steel (316) or glass with sharp, tapered leading edge. The angle of taper shall be ≤30° and the taper shall be on the outside to preserve a constant internal diameter. The probe nozzle shall be of the button-hook or elbow design, unless otherwise specified by the Administrator. If made of stainless steel, the nozzle shall be constructed from seamless tubing; other materials of construction may be used, subject to the approval of the Administrator.

A range of nozzle sizes suitable for isokinetic sampling should be available, e.g., 0.32 to 1.27 cm (⅛ to ½ in.)—or larger if higher volume sampling trains are used—inside diameter (ID) nozzles in increments of 0.16 cm (1/16 in.). Each nozzle shall be calibrated according to the procedures outlined in Section 5.

2.1.2 Probe Liner. Borosilicate or quartz glass tubing with a heating system capable of maintaining a gas temperature at the exit end during sampling of 120±14° C (248±25° F), or such other temperature as specified by an applicable subpart of the standards or approved by the Administrator for a particular application. (The tester may opt to operate the equipment at a temperature lower than that specified.) Since the actual temperature at the outlet of the probe is not usually monitored during sampling, probes constructed according to APTD-0581 and utilizing the calibration curves of APTD-0576 (or calibrated according to the procedure outlined in APTD-0576) will be considered acceptable.

Either borosilicate or quartz glass probe liners may be used for stack temperatures up to about 480° C (900° F); quartz liners shall be used for temperatures between 480 and 900° C (900 and 1,650° F). Both types of liners may be used at higher temperatures than specified for short periods of time, subject to the approval of the Administrator. The softening temperature for borosilicate is 820° C (1,508° F), and for quartz it is 1,500° C (2,732° F).

Whenever practical, every effort should be made to use borosilicate or quartz glass probe liners. Alternatively, metal liners (e.g., 316 stainless steel, Incoloy 825,[3] or other corrosion resistant metals) made of seamless tubing may be used, subject to the approval of the Administrator.

2.1.3 Pitot Tube. Type S, as described in Section 2.1 of Method 2, or other device approved by the Administrator. The pitot tube shall be attached to the probe (as shown in Figure 5-1) to allow constant monitoring of the stack gas velocity. The impact (high pressure) opening plane of the pitot tube shall be even with or above the nozzle entry plane (see Method 2, Figure 2-6b) during sampling. The Type S pitot tube assembly shall have a known coefficient, determined as outlined in Section 4 of Method 2.

2.1.4 Differential Pressure Gauge. Inclined manometer or equivalent device (two), as described in Section 2.2 of Method 2. One manometer shall be used for velocity head (Δp) readings, and the other, for orifice differential pressure readings.

2.1.5 Filter Holder. Borosilicate glass, with a glass frit filter support and a silicone rubber gasket. Other materials of construction (e.g., stainless steel, Teflon, Viton) may be used, subject to approval of the Administrator. The holder design shall provide a positive seal against leakage from the outside or around the filter. The holder shall be attached immediately at the outlet of the probe (or cyclone, if used).

2.1.6 Filter Heating System. Any heating system capable of maintaining a temperature around the filter holder during sampling of 120±14° C (248±25° F), or such other temperature as specified by an applicable subpart of the standards or approved by the Administrator for a particular application. Alternatively, the tester may opt to operate the equipment at a temperature lower than that specified. A temperature gauge capable of measuring temperature to within 3° C (5.4° F) shall be installed so that the temperature around the filter holder can be regulated and monitored during sampling. Heating systems other than the one shown in APTD-0581 may be used.

2.1.7 Condenser. The following system shall be used to determine the stack gas moisture content: Four impingers connected in series with leak-free ground glass fittings or any similar leak-free non-contaminating fittings. The first, third, and fourth impingers shall be of the Greenburg-Smith design, modified by replacing the tip with 1.3 cm (½ in.) ID glass tube extending to about 1.3 cm (½ in.) from the bottom of the flask. The second impinger shall be of the Greenburg-Smith design with the standard tip. Modifications (e.g., using flexible connections between the impingers, using materials other than glass, or using flexible vacuum lines to connect the filter holder to the condenser) may be used, subject to the approval of the Administrator. The first and second impingers shall contain known quantities of water (Section 4.1.3), the third shall be empty, and the fourth shall contain a known weight of silica gel, or equivalent desiccant. A thermometer, capable of measuring temperature to within 1° C (2° F) shall be placed at the outlet of the fourth impinger for monitoring purposes.

Alternatively, any system that cools the sample gas stream and allows measurement of the water condensed and moisture leaving the condenser, each to within 1 ml or 1 g may be used, subject to the approval of the Administrator. Acceptable means are to measure the condensed water either gravimetrically or volumetrically and to measure the moisture leaving the condenser by: (1) monitoring the temperature and pressure at the exit of the condenser and using Dalton's law of partial pressures; or (2) passing the sample gas stream through a tared silica gel (or equivalent desiccant) trap with exit gases kept below 20° C (68° F) and determining the weight gain.

If means other than silica gel are used to determine the amount of moisture leaving the condenser, it is recommended that silica gel (or equivalent) still be used between the condenser system and pump to prevent moisture condensation in the pump and metering devices and to avoid the need to make corrections for moisture in the metered volume.

NOTE.—If a determination of the particulate matter collected in the impingers is desired in addition to moisture content, the impinger system described above shall be used, without modification. Individual States or control agencies requiring this information shall be contacted as to the sample recovery and analysis of the impinger contents.

2.1.8 Metering System. Vacuum gauge, leak-free pump, thermometers capable of measuring temperature to within 3° C (5.4° F), dry gas meter capable of measuring volume to within 2 percent, and related equipment, as shown in Figure 5-1. Other metering systems capable of maintaining sampling rates within 10 percent of isokinetic and of determining sample volumes to within 2 percent may be used, subject to the approval of the Administrator. When the metering system is used in conjunction with a pitot tube, the system shall enable checks of isokinetic rates.

Sampling trains utilizing metering systems designed for higher flow rates than that described in APTD-0581 or APTD-0576 may be used provided that the specifications of this method are met.

2.1.9 Barometer. Mercury, aneroid, or other barometer capable of measuring atmospheric pressure to within 2.5 mm Hg (0.1 in. Hg). In many cases, the barometric reading may be obtained from a nearby national weather service station, in which case the station value (which is

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[3] Mention of trade names or specific products does not constitute endorsement by the Environmental Protection Agency.

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the absolute barometric pressure) shall be requested and an adjustment for elevation differences between the weather station and sampling point shall be applied at a rate of minus 2.5 mm Hg (0.1 in. Hg) per 30 m (100 ft) elevation increase or vice versa for elevation decrease.

2.1.10 Gas Density Determination Equipment. Temperature sensor and pressure gauge, as described in Sections 2.3 and 2.4 of Method 2, and gas analyzer, if necessary, as described in Method 3. The temperature sensor shall, preferably, be permanently attached to the pitot tube or sampling probe in a fixed configuration, such that the tip of the sensor extends beyond the leading edge of the probe sheath and does not touch any metal. Alternatively, the sensor may be attached just prior to use in the field. Note, however, that if the temperature sensor is attached in the field, the sensor must be placed in an interference-free arrangement with respect to the Type S pitot tube openings (see Method 2, Figure 2-7). As a second alternative, if a difference of not more than 1 percent in the average velocity measurement is to be introduced, the temperature gauge need not be attached to the probe or pitot tube. (This alternative is subject to the approval of the Administrator.)

2.2 Sample Recovery. The following items are needed:

2.2.1 Probe-Liner and Probe-Nozzle Brushes. Nylon bristle brushes with stainless steel wire handles. The probe brush shall have extensions (at least as long as the probe) of stainless steel, Nylon, Teflon, or similarly inert material. The brushes shall be properly sized and shaped to brush out the probe liner and nozzle.

2.2.2 Wash Bottles—Two. Glass wash bottles are recommended; polyethylene wash bottles may be used at the option of the tester. It is recommended that acetone not be stored in polyethylene bottles for longer than a month.

2.2.3 Glass Sample Storage Containers. Chemically resistant, borosilicate glass bottles, for acetone washes, 500 ml or 1000 ml. Screw cap liners shall either be rubber-backed Teflon or shall be constructed so as to be leak-free and resistant to chemical attack by acetone. (Narrow mouth glass bottles have been found to be less prone to leakage.) Alternatively, polyethylene bottles may be used.

2.2.4 Petri Dishes. For filter samples, glass or polyethylene, unless otherwise specified by the Administrator.

2.2.5 Graduated Cylinder and/or Balance. To measure condensed water to within 1 ml or 1 g. Graduated cylinders shall have subdivisions no greater than 2 ml. Most laboratory balances are capable of weighing to the nearest 0.5 g or less. Any of these balances is suitable for use here and in Section 2.3.4.

2.2.6 Plastic Storage Containers. Air-tight containers to store silica gel.

2.2.7 Funnel and Rubber Policeman. To aid in transfer of silica gel to container; not necessary if silica gel is weighed in the field.

2.2.8 Funnel. Glass or polyethlene, to aid in sample recovery.

2.3 Analysis. For analysis, the following equipment is needed.

2.3.1 Glass Weighing Dishes.

2.3.2 Desiccator.

2.3.3 Analytical Balance. To measure to within 0.1 mg.

2.3.4 Balance. To measure to within 0.5 g.

2.3.5 Beakers. 250 ml.

2.3.6 Hygrometer. To measure the relative humidity of the laboratory environment.

2.3.7 Temperature Gauge. To measure the temperature of the laboratory environment.

3. *Reagents*

3.1 Sampling. The reagents used in sampling are as follows:

3.1.1 Filters. Glass fiber filters, without organic binder, exhibiting at least 99.95 percent efficiency (≤0.05 percent penetration) on 0.3-micron dioctyl phthalate smoke particles. The filter efficiency test shall be conducted in accordance with ASTM standard method D 2986-71. Test data from the supplier's quality control program are sufficient for this purpose.

3.1.2 Silica Gel. Indicating type, 6 to 16 mesh. If previously used, dry at 175° C (350° F) for 2 hours. New silica gel may be used as received. Alternatively, other types of desiccants (equivalent or better) may be used, subject to the approval of the Administrator.

3.1.3 Water. When analysis of the material caught in the impingers is required, distilled water shall be used. Run blanks prior to field use to eliminate a high blank on test samples.

3.1.4 Crushed Ice.

3.1.5 Stopcock Grease. Acetone-insoluble, heat-stable silicone grease. This is not necessary if screw-on connectors with Teflon sleeves, or similar, are used. Alternatively, other types of stopcock grease may be used, subject to the approval of the Administrator.

3.2 Sample Recovery. Acetone—reagent grade, ≤0.001 percent residue, in glass bottles—is required. Acetone from metal containers generally has a high residue blank and should not be used. Sometimes, suppliers transfer acetone to glass bottles from metal containers; thus, acetone blanks shall be run prior to field use and only acetone with low blank values (≤0.001 percent) shall be used. In no case shall a blank value of greater than 0.001 percent of the weight of acetone used be subtracted from the sample weight.

3.3 Analysis. Two reagents are required for the analysis:

3.3.1 Acetone. Same as 3.2.

3.3.2 Desiccant. Anhydrous calcium sulfate, indicating type. Alternatively, other types of desiccants may be used, subject to the approval of the Administrator.

4. *Procedure*

4.1 Sampling. The complexity of this method is such that, in order to obtain reliable results, testers should be trained and experienced with the test procedures.

4.1.1 Pretest Preparation. All the components shall be maintained and calibrated according to the procedure described in APTD-0576, unless otherwise specified herein.

Weigh several 200 to 300 g portions of silica gel in air-tight containers to the nearest 0.5 g. Record the total weight of the silica gel plus container, on each container. As an alternative, the silica gel need not be preweighed, but may be weighed directly in its impinger or sampling holder just prior to train assembly.

Check filters visually against light for irregularities and flaws or pinhole leaks. Label filters of the proper diameter on the back side near the edge using numbering machine ink. As an alternative, label the shipping containers (glass or plastic petri dishes) and keep the filters in these containers at all times except during sampling and weighing.

Desiccate the filters at 20±5.6° C (68±10° F) and ambient pressure for at least 24 hours and weigh at intervals of at least 6 hours to a constant weight, i.e., <0.5 mg change from previous weighing; record results to the nearest 0.1 mg. During each weighing the filter must not be exposed to the laboratory atmosphere for a period greater than 2 minutes and a relative humidity above 50 percent. Alternatively (unless otherwise specified by the Administrator), the filters may be oven dried at 105° C (220° F) for 2 to 3 hours, desiccated for 2 hours, and weighed. Procedures other than those described, which account for relative humidity effects, may be used, subject to the approval of the Administrator.

4.1.2 Preliminary Determinations. Select the sampling site and the minimum number of sampling points according to Method 1 or as specified by the Administrator. Determine the stack pressure, temperature, and the range of velocity heads using Method 2; it is recommended that a leak-check of the pitot lines (see Method 2, Section 3.1) be performed. Determine the moisture content using Approximation Method 4 or its alternatives for the purpose of making isokinetic sampling rate settings. Determine the stack gas dry molecular weight, as described in Method 2, Section 3.6; if integrated Method 3 sampling is used for molecular weight determination, the integrated bag sample shall be taken simultaneously with, and for the same total length of time as, the particulate sample run.

Select a nozzle size based on the range of velocity heads, such that it is not necessary to change the nozzle size in order to maintain isokinetic sampling rates. During the run, do not change the nozzle size. Ensure that the proper differential pressure gauge is chosen for the range of velocity heads encountered (see Section 2.2 of Method 2).

Select a suitable probe liner and probe length such that all traverse points can be sampled. For large stacks, consider sampling from opposite sides of the stack to reduce the length of probes.

Select a total sampling time greater than or equal to the minimum total sampling time specified in the test procedures for the specific industry such that (1) the sampling time per point is not less than 2 min (or some greater time interval as specified by the Administrator), and (2) the sample volume taken (corrected to standard conditions) will exceed the required minimum total gas sample volume. The latter is based on an approximate average sampling rate.

It is recommended that the number of minutes sampled at each point be an integer or an integer plus one-half minute, in order to avoid timekeeping errors.

In some circumstances, e.g., batch cycles, it may be necessary to sample for shorter times at the traverse points and to obtain smaller gas sample volumes. In these cases, the Administrator's approval must first be obtained.

4.1.3 Preparation of Collection Train. During preparation and assembly of the sampling train, keep all openings where contamination can occur covered until just prior to assembly or until sampling is about to begin.

Place 100 ml of water in each of the first two impingers, leave the third impinger empty, and transfer approximately 200 to 300 g of preweighed silica gel from its container to the fourth impinger. More silica gel may be used, but care should be taken to ensure that it is not entrained and carried out from the impinger during sampling. Place the container in a clean place for later use in the sample recovery. Alternatively, the weight of the silica gel plus impinger may be determined to the nearest 0.5 g and recorded.

Using a tweezer or clean disposable surgical gloves, place a labeled (identified) and weighed filter in the filter holder. Be sure that the filter is properly centered and the gasket properly placed so as to prevent the sample gas stream from circumventing the filter. Check the filter for tears after assembly is completed.

When glass liners are used, install the selected nozzle using a Viton A O-ring when stack temperatures are less than 260° C (500° F) and an asbestos string gasket when temperatures are higher. See APTD-0576 for details. Other connecting systems using either 316 stainless steel or Teflon ferrules may be used. When metal liners are used, install the nozzle as above or by a leak-free direct mechanical connection. Mark the probe with heat resistant tape or by some other method to denote the proper distance into the stack or duct for each sampling point.

Set up the train as in Figure 5-1, using (if necessary) a very light coat of silicone grease on all ground glass joints, greasing only the outer portion (see APTD-0576) to avoid possibility of contamination by the silicone grease. Subject to the approval of the Administrator, a glass cyclone may be used between the probe and filter holder when the total particulate catch is expected to exceed 100 mg or when water droplets are present in the stack gas.

Place crushed ice around the impingers.

4.1.4 Leak-Check Procedures.

4.1.4.1 Pretest Leak-Check. A pretest leak-check is recommended, but not required. If the tester opts to conduct the pretest leak-check, the following procedure shall be used.

After the sampling train has been assembled, turn on and set the filter and probe heating systems at the desired operating temperatures. Allow time for the temperatures to stabilize. If a Viton A O-ring or other leak-free connection is used in assembling the probe nozzle to the probe liner, leak-check the train at the sampling site by plugging the nozzle and pulling a 380 mm Hg (15 in. Hg) vacuum.

NOTE.—A lower vacuum may be used, provided that it is not exceeded during the test.

If an asbestos string is used, do not connect the probe to the train during the leak-check. Instead, leak-check the train by first plugging the inlet to the filter holder (cyclone, if applicable) and pulling a 380 mm Hg (15 in. Hg) vacuum (see Note immediately above). Then connect the probe to the train and leak-check at about 25 mm Hg (1 in. Hg) vacuum; alternatively, the probe may be leak-checked with the rest of the sampling train, in one step, at 380 mm Hg (15 in. Hg) vacuum. Leakage rates in excess of 4 percent of the average sampling rate or 0.00057 m^3/min (0.02 cfm), whichever is less, are unacceptable.

The following leak-check instructions for the sampling train described in APTD-0576 and APTD-0581 may be helpful. Start the pump with bypass valve fully open and coarse adjust valve completely closed. Partially open the coarse adjust valve and slowly close the bypass valve until the desired vacuum is reached. Do not reverse direction of bypass valve; this will cause water to back up into the filter holder. If the desired vacuum is exceeded, either leak-check at this higher vacuum or end the leak check as shown below and start over.

When the leak-check is completed, first slowly remove the plug from the inlet to the probe, filter holder, or cyclone (if applicable) and immediately turn off the vacuum pump. This prevents the water in the impingers from being forced backward into the filter holder and silica gel from being entrained backward into the third impinger.

4.1.4.2 Leak-Checks During Sample Run. If, during the sampling run, a component (e.g., filter assembly or impinger) change becomes necessary, a leak-check shall be conducted immediately before the change is made. The leak-check shall be done according to the procedure outlined in Section 4.1.4.1 above, except that it shall be done at a vacuum equal to or greater than the maximum value recorded up to that point in the test. If the leakage rate is found to be no greater than 0.00057 m^3/min (0.02 cfm) or 4 percent of the average sampling rate (whichever is less), the results are acceptable, and no correction will need to be applied to the total volume of dry gas metered; if, however, a higher leakage rate is obtained, the tester shall either record the leakage rate and plan to correct the sample volume as shown in Section 6.3 of this method, or shall void the sampling run.

Immediately after component changes, leak-checks are optional; if such leak-checks are done, the procedure outlined in Section 4.1.4.1 above shall be used.

4.1.4.3 Post-test Leak-Check. A leak-check is mandatory at the conclusion of each sampling run. The leak-check shall be done in accordance with the procedures outlined in Section 4.1.4.1, except that it shall be conducted at a vacuum equal to or greater than the maximum value reached during the sampling run. If the leakage rate is found to be no greater than 0.00057 m^3/min (0.02 cfm) or 4 percent of the average sampling rate (whichever is less), the results are acceptable, and no correction need be applied to the total volume of dry gas metered. If, however, a higher leakage rate is obtained, the tester shall either record the leakage rate and correct the sample volume as shown in Section 6.3 of this method, or shall void the sampling run.

4.1.5 Particulate Train Operation. During the sampling run, maintain an isokinetic sampling rate (within 10 percent of true isokinetic unless otherwise specified by the Administrator) and a temperature around the filter of 120±14° C (248±25° F), or such other temperature as specified by an applicable subpart of the standards or approved by the Administrator.

For each run, record the data required on a data sheet such as the one shown in Figure 5-2. Be sure to record the initial dry gas meter reading. Record the dry gas meter readings at the beginning and end of each sampling time increment, when changes in flow rates are made, before and after each leak check, and when sampling is halted.

Take other readings required by Figure 5-2 at least once at each sample point during each time increment and additional readings when significant changes (20 percent variation in velocity head readings) necessitate additional adjustments in flow rate. Level and zero the manometer. Because the manometer level and zero may drift due to vibrations and temperature changes, make periodic checks during the traverse.

Clean the portholes prior to the test run to minimize the chance of sampling deposited material. To begin sampling, remove the nozzle cap, verify that the filter and probe heating systems are up to temperature, and that the pitot tube and probe are properly positioned. Position the nozzle at the first traverse point with the tip pointing directly into the gas stream. Immediately start the pump and adjust the flow to isokinetic conditions. Nomographs are available, which aid in the rapid adjustment of the isokinetic sampling rate without excessive computations. These nomographs are designed for use when the Type S pitot tube coefficient is 0.85±0.02, and the stack gas equivalent density (dry molecular weight) is equal to 29±4. APTD-0576 details the procedure for using the nomographs. If C_p and M_d are outside the above stated ranges do not use the nomographs unless appropriate steps (see Citation 7 in Section 7) are taken to compensate for the deviations.

PLANT __________
LOCATION __________
OPERATOR __________
DATE __________
RUN NO. __________
SAMPLE BOX NO. __________
METER BOX NO. __________
METER ΔH@ __________
C FACTOR __________
PITOT TUBE COEFFICIENT, C_p __________

SCHEMATIC OF STACK CROSS SECTION

AMBIENT TEMPERATURE __________
BAROMETRIC PRESSURE __________
ASSUMED MOISTURE, % __________
PROBE LENGTH, m (ft) __________
NOZZLE IDENTIFICATION NO. __________
AVERAGE CALIBRATED NOZZLE DIAMETER, cm (in.) __________
PROBE HEATER SETTING __________
LEAK RATE, m^3/min.(cfm) __________
PROBE LINER MATERIAL __________
STATIC PRESSURE, mm Hg (in. Hg) __________
FILTER NO. __________

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min.	VACUUM mm Hg (in. Hg)	STACK TEMPERATURE (T_S) °C (°F)	VELOCITY HEAD (ΔP_S), mm (in.) H_2O	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER mm H_2O (in. H_2O)	GAS SAMPLE VOLUME m^3 (ft^3)	GAS SAMPLE TEMPERATURE AT DRY GAS METER		FILTER HOLDER TEMPERATURE, °C (°F)	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER, °C (°F)
							INLET °C (°F)	OUTLET °C (°F)		
TOTAL							Avg.	Avg.		
AVERAGE							Avg.			

Figure 5-2. Particulate field data.

When the stack is under significant negative pressure (height of impinger stem), take care to close the coarse adjust valve before inserting the probe into the stack to prevent water from backing into the filter holder. If necessary, the pump may be turned on with the coarse adjust valve closed.

When the probe is in position, block off the openings around the probe and porthole to prevent unrepresentative dilution of the gas stream.

Traverse the stack cross-section, as required by Method 1 or as specified by the Administrator, being careful not to bump the probe nozzle into the stack walls when sampling near the walls or when removing or inserting the probe through the portholes; this minimizes the chance of extracting deposited material.

During the test run, make periodic adjustments to keep the temperature around the filter holder at the proper level; add more ice and, if necessary, salt to maintain a temperature of less than 20° C (68° F) at the condenser/silica gel outlet. Also, periodically check the level and zero of the manometer.

If the pressure drop across the filter becomes too high, making isokinetic sampling difficult to maintain, the filter may be replaced in the midst of a sample run. It is recommended that another complete filter assembly be used rather than attempting to change the filter itself. Before a new filter assembly is installed, conduct a leak-check (see Section 4.1.4.2). The total particulate weight shall include the summation of all filter assembly catches.

A single train shall be used for the entire sample run, except in cases where simultaneous sampling is required in two or more separate ducts or at two or more different locations within the same duct, or, in cases where equipment failure necessitates a change of trains. In all other situations, the use of two or more trains will be subject to the approval of the Administrator.

Note that when two or more trains are used, separate analyses of the front-half and (if applicable) impinger catches from each train shall be performed, unless identical nozzle sizes were used on all trains, in which case, the front-half catches from the individual trains may be combined (as may the impinger catches) and one analysis of front-half catch and one analysis of impinger catch may be performed. Consult with the Administrator for details concerning the calculation of results when two or more trains are used.

At the end of the sample run, turn off the coarse adjust valve, remove the probe and nozzle from the stack, turn off the pump, record the final dry gas meter reading, and conduct a post-test leak-check, as outlined in Section 4.1.4.3. Also, leak-check the pitot lines as described in Method 2, Section 3.1; the lines must pass this leak-check, in order to validate the velocity head data.

4.1.6 Calculation of Percent Isokinetic. Calculate percent isokinetic (see Calculations, Section 6) to determine whether the run was valid or another test run should be made. If there was difficulty in maintaining isokinetic rates due to source conditions, consult with the Administrator for possible variance on the isokinetic rates.

4.2 Sample Recovery. Proper cleanup procedure begins as soon as the probe is removed from the stack at the end of the sampling period. Allow the probe to cool.

When the probe can be safely handled, wipe off all external particulate matter near the tip of the probe nozzle and place a cap over it to prevent losing or gaining particulate matter. Do not cap off the probe tip tightly while the sampling train is cooling down as this would create a vacuum in the filter holder, thus drawing water from the impingers into the filter holder.

Before moving the sample train to the cleanup site, remove the probe from the sample train, wipe off the silicone grease, and cap the open outlet of the probe. Be careful not to lose any condensate that might be present. Wipe off the silicone grease from the filter inlet where the probe was fastened and cap it. Remove the umbilical cord from the last impinger and cap the impinger. If a flexible line is used between the first impinger or condenser and the filter holder, disconnect the line at the filter holder and let any condensed water or liquid drain into the impingers or condenser. After wiping off the silicone grease, cap off the filter holder outlet and impinger inlet. Either ground-glass stoppers, plastic caps, or serum caps may be used to close these openings.

Transfer the probe and filter-impinger assembly to the cleanup area. This area should be clean and protected from the wind so that the chances of contaminating or losing the sample will be minimized.

Save a portion of the acetone used for cleanup as a blank. Take 200 ml of this acetone directly from the wash bottle being used and place it in a glass sample container labeled "acetone blank."

Inspect the train prior to and during disassembly and note any abnormal conditions. Treat the samples as follows:

Container No. 1. Carefully remove the filter from the filter holder and place it in its identified petri dish container. Use a pair of tweezers and/or clean disposable surgical gloves to handle the filter. If it is necessary to fold the filter, do so such that the particulate cake is inside the fold. Carefully transfer to the petri dish any particulate matter and/or filter fibers which adhere to the filter holder gasket, by using a dry nylon bristle brush and/or a sharp-edged blade. Seal the container.

Container No. 2. Taking care to see that dust on the outside of the probe or other exterior surfaces does not get into the sample, quantitatively recover particulate matter or any condensate from the probe nozzle, probe fitting, probe liner, and front half of the filter holder by washing these components with acetone and placing the wash in a glass container. Distilled water may be used instead of acetone when approved by the Administrator and shall be used when specified by the Administrator; in these cases, save a water blank and follow the Administrator's directions on analysis. Perform the acetone rinses as follows:

Carefully remove the probe nozzle and clean the inside surface by rinsing with acetone from a wash bottle and brushing with a nylon bristle brush. Brush until the acetone rinse shows no visible particles, after which make a final rinse of the inside surface with acetone.

Brush and rinse the inside parts of the Swagelok fitting with acetone in a similar way until no visible particles remain.

Rinse the probe liner with acetone by tilting and rotating the probe while squirting acetone into its upper end so that all inside surfaces will be wetted with acetone. Let the acetone drain from the lower end into the sample container. A funnel (glass or polyethylene) may be used to aid in transferring liquid washes to the container. Follow the acetone rinse with a probe brush. Hold the probe in an inclined position, squirt acetone into the upper end as the probe brush is being pushed with a twisting action through the probe; hold a sample container underneath the lower end of the probe, and catch any acetone and particulate matter which is brushed from the probe. Run the brush through the probe three times or more until no visible particulate matter is carried out with the acetone or until none remains in the probe liner on visual inspection. With stainless steel or other metal probes, run the brush through in the above prescribed manner at least six times since metal probes have small crevices in which particulate matter can be entrapped. Rinse the brush with acetone, and quantitatively collect these washings in the sample container. After the brushing, make a final acetone rinse of the probe as described above.

It is recommended that two people be used to clean the probe to minimize sample losses. Between sampling runs, keep brushes clean and protected from contamination.

After ensuring that all joints have been wiped clean of silicone grease, clean the inside of the front half of the filter holder by rubbing the surfaces with a nylon bristle brush and rinsing with acetone. Rinse each surface three times or more if needed to remove visible particulate. Make a final rinse of the brush and filter holder. Carefully rinse out the glass cyclone, also (if applicable). After all acetone washings and particulate matter have been collected in the sample container, tighten the lid on the sample container so that acetone will not leak out when it is shipped to the laboratory. Mark the height of the fluid level to determine whether or not leakage occurred during transport. Label the container to clearly identify its contents.

Container No. 3. Note the color of the indicating silica gel to determine if it has been completely spent and make a notation of its condition. Transfer the silica gel from the fourth impinger to its original container and seal. A funnel may make it easier to pour the silica gel without spilling. A rubber policeman may be used as an aid in removing the silica gel from the impinger. It is not necessary to remove the small amount of dust particles that may adhere to the impinger wall and are difficult to remove. Since the gain in weight is to be used for moisture calculations, do not use any water or other liquids to transfer the silica gel. If a balance is available in the field, follow the procedure for container No. 3 in Section 4.3.

Impinger Water. Treat the impingers as follows: Make a notation of any color or film in the liquid catch. Measure the liquid which is in the first three impingers to within ±1 ml by using a graduated cylinder or by weighing it to within ±0.5 g by using a balance (if one is available). Record the volume or weight of liquid present. This information is required to calculate the moisture content of the effluent gas.

Discard the liquid after measuring and recording the volume or weight, unless analysis of the impinger catch is required (see Note, Section 2.1.7).

If a different type of condenser is used, measure the amount of moisture condensed either volumetrically or gravimetrically.

Whenever possible, containers should be shipped in such a way that they remain upright at all times.

4.3 Analysis. Record the data required on a sheet such as the one shown in Figure 5-3. Handle each sample container as follows:

Container No. 1. Leave the contents in the shipping container or transfer the filter and any loose particulate from the sample container to a tared glass weighing dish. Desiccate for 24 hours in a desiccator containing anhydrous calcium sulfate. Weigh to a constant weight and report the results to the nearest 0.1 mg. For purposes of this Section, 4.3, the term "constant weight" means a difference of no more than 0.5 mg or 1 percent of total weight less tare weight, whichever is greater, between two consecutive weighings, with no less than 6 hours of desiccation time between weighings.

Plant ______________________________

Date ______________________________

Run No. ______________________________

Filter No. ______________________________

Amount liquid lost during transport ______________________________

Acetone blank volume, ml ______________________________

Acetone wash volume, ml ______________________________

Acetone blank concentration, mg/mg (equation 5-4) ______________________________

Acetone wash blank, mg (equation 5-5) ______________________________

CONTAINER NUMBER	WEIGHT OF PARTICULATE COLLECTED, mg		
	FINAL WEIGHT	TARE WEIGHT	WEIGHT GAIN
1			
2			
TOTAL			
		Less acetone blank	
		Weight of particulate matter	

	VOLUME OF LIQUID WATER COLLECTED	
	IMPINGER VOLUME, ml	SILICA GEL WEIGHT, g
FINAL		
INITIAL		
LIQUID COLLECTED		
TOTAL VOLUME COLLECTED		g* ml

* CONVERT WEIGHT OF WATER TO VOLUME BY DIVIDING TOTAL WEIGHT INCREASE BY DENSITY OF WATER (1g/ml).

$$\frac{\text{INCREASE, g}}{1\ \text{g/ml}} = \text{VOLUME WATER, ml}$$

Figure 5-3. Analytical data.

Alternatively, the sample may be oven dried at 105° C (220° F) for 2 to 3 hours, cooled in the desiccator, and weighed to a constant weight, unless otherwise specified by the Administrator. The tester may also opt to oven dry the sample at 105° C (220° F) for 2 to 3 hours, weigh the sample, and use this weight as a final weight.

Container No. 2. Note the level of liquid in the container and confirm on the analysis sheet whether or not leakage occurred during transport. If a noticeable amount of leakage has occurred, either void the sample or use methods, subject to the approval of the Administrator, to correct the final results. Measure the liquid in this container either volumetrically to ±1 ml or gravimetrically to ±0.5 g. Transfer the contents to a tared 250-ml beaker and evaporate to dryness at ambient temperature and pressure. Desiccate for 24 hours and weigh to a constant weight. Report the results to the nearest 0.1 mg.

Container No. 3. Weigh the spent silica gel (or silica gel plus impinger) to the nearest 0.5 g using a balance. This step may be conducted in the field.

"Acetone Blank" Container. Measure acetone in this container either volumetrically or gravimetrically. Transfer the acetone to a tared 250-ml beaker and evaporate to dryness at ambient temperature and pressure. Desiccate for 24 hours and weigh to a constant weight. Report the results to the nearest 0.1 mg.

NOTE.—At the option of the tester, the contents of Container No. 2 as well as the acetone blank container may be evaporated at temperatures higher than ambient. If evaporation is done at an elevated temperature, the temperature must be below the boiling point of the solvent; also, to prevent "bumping," the evaporation process must be closely supervised, and the contents of the beaker must be swirled occasionally to maintain an even temperature. Use extreme care, as acetone is highly flammable and has a low flash point.

5. *Calibration*

Maintain a laboratory log of all calibrations.

5.1 Probe Nozzle. Probe nozzles shall be calibrated before their initial use in the field. Using a micrometer, measure the inside diameter of the nozzle to the nearest 0.025 mm (0.001 in.). Make three separate measurements using different diameters each time, and obtain the average of the measurements. The difference between the high and low numbers shall not exceed 0.1 mm (0.004 in.). When nozzles become nicked, dented, or corroded, they shall be reshaped, sharpened, and recalibrated before use. Each nozzle shall be permanently and uniquely identified.

5.2 Pitot Tube. The Type S pitot tube assembly shall be calibrated according to the procedure outlined in Section 4 of Method 2.

5.3 Metering System. Before its initial use in the field, the metering system shall be calibrated according to the procedure outlined in APTD-0576. Instead of physically adjusting the dry gas meter dial readings to correspond to the wet test meter readings, calibration factors may be used to mathematically correct the gas meter dial readings to the proper values. Before calibrating the metering system, it is suggested that a leak-check be conducted. For metering systems having diaphragm pumps, the normal leak-check procedure will not detect leakages within the pump. For these cases the following leak-check procedure is suggested: make a 10-minute calibration run at 0.00057 m³/min (0.02 cfm); at the end of the run, take the difference of the measured wet test meter and dry gas meter volumes; divide the difference by 10, to get the leak rate. The leak rate should not exceed 0.00057 m³/min (0.02 cfm).

After each field use, the calibration of the metering system shall be checked by performing three calibration runs at a single, intermediate orifice setting (based on the previous field test), with the vacuum set at the maximum value reached during the test series. To adjust the vacuum, insert a valve between the wet test meter and the inlet of the metering system. Calculate the average value of the calibration factor. If the calibration has changed by more than 5 percent, recalibrate the meter over the full range of orifice settings, as outlined in APTD-0576.

Alternative procedures, e.g., using the orifice meter coefficients, may be used, subject to the approval of the Administrator.

NOTE.—If the dry gas meter coefficient values obtained before and after a test series differ by more than 5 percent, the test series shall either be voided, or calculations for the test series shall be performed using whichever meter coefficient value (i.e., before or after) gives the lower value of total sample volume.

5.4 Probe Heater Calibration. The probe heating system shall be calibrated before its initial use in the field according to the procedure outlined in APTD-0576. Probes constructed according to APTD-0581 need not be calibrated if the calibration curves in APTD-0576 are used.

5.5 Temperature Gauges. Use the procedure in Section 4.3 of Method 2 to calibrate in-stack temperature gauges. Dial thermometers, such as are used for the dry gas meter and condenser outlet, shall be calibrated against mercury-in-glass thermometers.

5.6 Leak Check of Metering System Shown in Figure 5-1. That portion of the sampling train from the pump to the orifice meter should be leak checked prior to initial use and after each shipment. Leakage after the pump will result in less volume being recorded than is actually sampled. The following procedure is suggested (see Figure 5-4): Close the main valve on the meter box. Insert a one-hole rubber stopper with rubber tubing attached into the orifice exhaust pipe. Disconnect and vent the low side of the orifice manometer. Close off the low side orifice tap. Pressurize the system to 13 to 18 cm (5 to 7 in.) water column by blowing into the rubber tubing. Pinch off the tubing and observe the manometer for one minute. A loss of pressure on the manometer indicates a leak in the meter box; leaks, if present, must be corrected.

5.7 Barometer. Calibrate against a mercury barometer.

6. *Calculations*

Carry out calculations, retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after the final calculation. Other forms of the equations may be used as long as they give equivalent results.

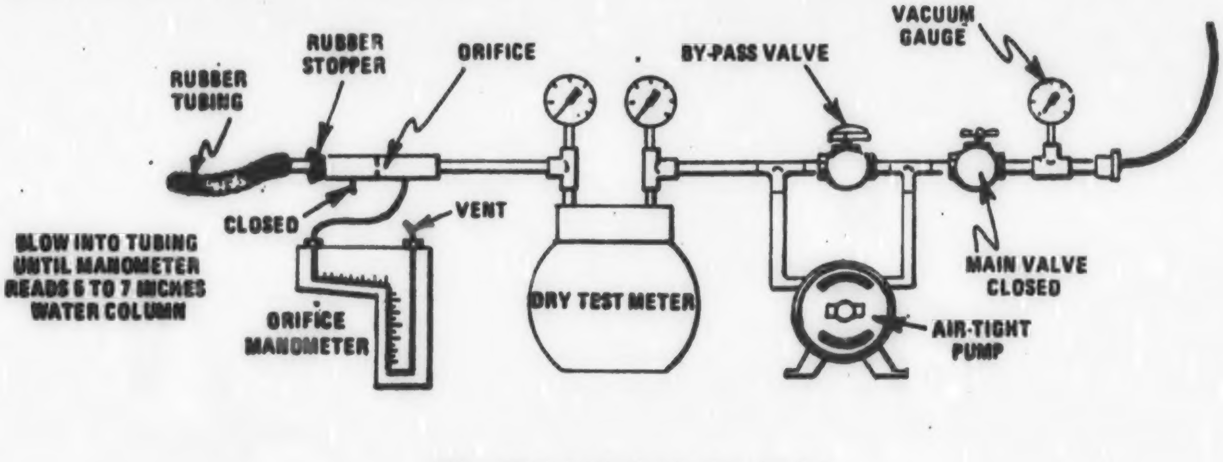

Figure 5-4. Leak check of meter box.

6.1 Nomenclature

A_n = Cross-sectional area of nozzle, m² (ft²).

B_{ws} = Water vapor in the gas stream, proportion by volume.

C_a = Acetone blank residue concentrations, mg/g.

c_s = Concentration of particulate matter in stack gas, dry basis, corrected to standard conditions, g/dscm (g/dscf).

I = Percent of isokinetic sampling.

L_a = Maximum acceptable leakage rate for either a pretest leak check or for a leak check following a component change; equal to 0.00057 m³/min (0.02 cfm) or 4 percent of the average sampling rate, whichever is less.

L_i = Individual leakage rate observed during the leak check conducted prior to the "i^{th}" component change (i=1, 2, 3 . . . . n), m³/min (cfm).

L_p = Leakage rate observed during the post-test leak check, m³/min (cfm).

m_n = Total amount of particulate matter collected, mg.

M_w = Molecular weight of water, 18.0 g/g-mole (18.0 lb/lb-mole).

m_a = Mass of residue of acetone after evaporation, mg.

P_{bar} = Barometric pressure at the sampling site, mm Hg (in. Hg).

P_s = Absolute stack gas pressure, mm Hg (in. Hg).

P_{std} = Standard absolute pressure, 760 mm Hg (29.92 in. Hg).

R = Ideal gas constant, 0.06236 mm Hg-m³/°K-g-mole (21.85 in. Hg-ft³/°R-lb-mole).

T_m = Absolute average dry gas meter temperature (see Figure 5-2), °K (°R).

T_s = Absolute average stack gas temperature (see Figure 5-2), °K (°R).

T_{std} = Standard absolute temperature, 293° K (528° R).

V_a = Volume of acetone blank, ml.

V_{aw} = Volume of acetone used in wash, ml.

V_{lc} = Total volume of liquid collected in impingers and silica gel (see Figure 5-3), ml.

V_m = Volume of gas sample as measured by dry gas meter, dcm (dcf).

$V_{m(std)}$ = Volume of gas sample measured by the dry gas meter, corrected to standard conditions, dscm (dscf).

$V_{w(std)}$ = Volume of water vapor in the gas sample, corrected to standard conditions, scm (scf).

v_s = Stack gas velocity, calculated by Method 2, Equation 2-9, using data obtained from Method 5, m/sec (ft/sec).

W_a = Weight of residue in acetone wash, mg.

Y = Dry gas meter calibration factor.

ΔH = Average pressure differential across the orifice meter (see Figure 5-2), mm H_2O (in. H_2O).

ρ_a = Density of acetone, mg/ml (see label on bottle).

ρ_w = Density of water, 0.9982 g/ml (0.002201 lb/ml).

θ = Total sampling time, min.

θ_1 = Sampling time interval, from the beginning of a run until the first component change, min.

θ_i = Sampling time interval, between two successive component changes, beginning with the interval between the first and second changes, min.

θ_p = Sampling time interval, from the final (n^{th}) component change until the end of the sampling run, min.

13.6 = Specific gravity of mercury.

60 = Sec/min.

100 = Conversion to percent.

6.2 Average dry gas meter temperature and average orifice pressure drop. See data sheet (Figure 5-2).

6.3 Dry Gas Volume. Correct the sample volume measured by the dry gas meter to standard conditions (20° C, 760 mm Hg or 68° F, 29.92 in. Hg) by using Equation 5-1.

$$V_{m(std)} = V_m Y \left(\frac{T_{std}}{T_m}\right)\left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{P_{std}}\right]$$

$$= K_1 V_m Y \frac{P_{bar} + (\Delta H/13.6)}{T_m}$$

Equation 5-1

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where:
K_1=0.3858 °K/mm Hg for metric units
=17.64 °R/in. Hg for English units

NOTE.—Equation 5-1 can be used as written unless the leakage rate observed during any of the mandatory leak checks (i.e., the post-test leak check or leak checks conducted prior to component changes) exceeds L_a. If L_p or L_i exceeds L_a, Equation 5-1 must be modified as follows;

(a) Case I. No component changes made during sampling run. In this case, replace V_m in Equation 5-1 with the expression;

$$V_m-(L_p-L_a)\theta]$$

(b) Case II. One or more component changes made during the sampling run. In this case, replace V_m in Equation 5-1 by the expression:

$$\left[V_m-(L_1-L_a)\theta_1-\sum_{i=2}^{n}(L_i-L_a)\theta_i-(L_p-L_a)\theta_p\right]$$

and substitute only for those leakage rates (L_i or L_p) which exceed L_a.

6.4 Volume of water vapor.

Equation 5-2

$$V_{w(std)}=V_{lc}\left(\frac{\rho_w}{M_w}\right)\left(\frac{RT_{std}}{P_{std}}\right)=K_2V_{lc}$$

where:
K_2=0.001333 m³/ml for metric units
=0.04707 ft³/ml for English units.

6.5 Moisture Content.

$$B_{ws}=\frac{V_{w(std)}}{V_{m(std)}+V_{w(std)}}$$

Equation 5-3

NOTE.—In saturated or water droplet-laden gas streams, two calculations of the moisture content of the stack gas shall be made, one from the impinger analysis (Equation 5-3), and a second from the assumption of saturated conditions. The lower of the two values of B_{ws} shall be considered correct. The procedure for determining the moisture content based upon assumption of saturated conditions is given in the Note of Section 1.2 of Method 4. For the purposes of this method, the average stack gas temperature from Figure 5-2 may be used to make this determination, provided that the accuracy of the in-stack temperature sensor is ± 1° C (2° F).

6.6 Acetone Blank Concentration.

$$C_a=\frac{m_a}{V_a\rho_a}$$

Equation 5-4

6.7 Acetone Wash Blank.

$$W_a=C_aV_{aw}\rho_a$$

Equation 5-5

6.8 Total Particulate Weight. Determine the total particulate catch from the sum of the weights obtained from containers 1 and 2 less the acetone blank (see Figure 5-8). NOTE.—Refer to Section 4.1.5 to assist in calculation of results involving two or more filter assemblies or two or more sampling trains.

6.9 Particulate Concentration.

$$c_s=(0.001\ g/mg)\ (m_n/V_{m(std)})$$

Equation 5-6

6.10 Conversion Factors:

From	To	Multiply by
scf	m³	0.02832
g/ft³	gr/ft³	15.43
g/ft³	lb/ft³	2.205×10⁻³
g/ft³	g/m³	35.31

6.11 Isokinetic Variation.

6.11.1 Calculation From Raw Data.

$$I=\frac{100\,T_s[K_3V_{lc}+(V_m/T_m)(P_{bar}+\Delta H/13.6)]}{60\,\theta v_sP_sA_n}$$

Equation 5-7

where:
K_3=0.003454 mm Hg−m³/ml−°K for metric units.
=0.002669 in. Hg−ft³/ml−°R for English units.

6.11.2 Calculation From Intermediate Values.

$$I=\frac{T_sV_{m(std)}P_{std}100}{T_{std}v_s\theta A_nP_s60(1-B_{ws})}$$

$$=K_4\frac{T_sV_{m(std)}}{P_sv_sA_n\theta(1-B_{ws})}$$

Equation 5-8

where:
K_4=4.320 for metric units
=0.09450 for English units.

6.12 Acceptable Results. If 90 percent ≤ I ≤ 110 percent, the results are acceptable. If the results are low in comparison to the standard and I is beyond the acceptable range, or, if I is less than 90 percent, the Administrator may opt to accept the results. Use Citation 4 to make judgments. Otherwise, reject the results and repeat the test.

7. *Bibliography*

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METHOD 6—DETERMINATION OF SULFUR DIOXIDE EMISSIONS FROM STATIONARY SOURCES

1. *Principle and Applicability*

1.1 Principle. A gas sample is extracted from the sampling point in the stack. The sulfuric acid mist (including sulfur trioxide) and the sulfur dioxide are separated. The sulfur dioxide fraction is measured by the barium-thorin titration method.

1.2 Applicability. This method is applicable for the determination of sulfur dioxide emissions from stationary sources. The minimum detectable limit of the method has been determined to be 3.4 milligrams (mg) of SO_2/m^3 (2.12×10^{-7} lb/ft³). Although no upper limit has been established, tests have shown that concentrations as high as 80,000 mg/m³ of SO_2 can be collected efficiently in two midget impingers, each containing 15 milliliters of 3 percent hydrogen peroxide, at a rate of 1.0 lpm for 20 minutes. Based on theoretical calculations, the upper concentration limit in a 20-liter sample is about 93,300 mg/m³.

Possible interferents are free ammonia, water-soluble cations, and fluorides. The cations and fluorides are removed by glass wool filters and an isopropanol bubbler, and hence do not affect the SO_2 analysis. When samples are being taken from a gas stream with high concentrations of very fine metallic fumes (such as in inlets to control devices), a high-efficiency glass fiber filter must be used in place of the glass wool plug (i.e., the one in the probe) to remove the cation interferents.

Free ammonia interferes by reacting with SO_2 to form particulate sulfite and by reacting with the indicator. If free ammonia is present (this can be determined by knowledge of the process and noticing white particulate matter in the probe and isopropanol bubbler), alternative methods, subject to the approval of the Administrator, U.S. Environmental Protection Agency, are required.

2. *Apparatus*

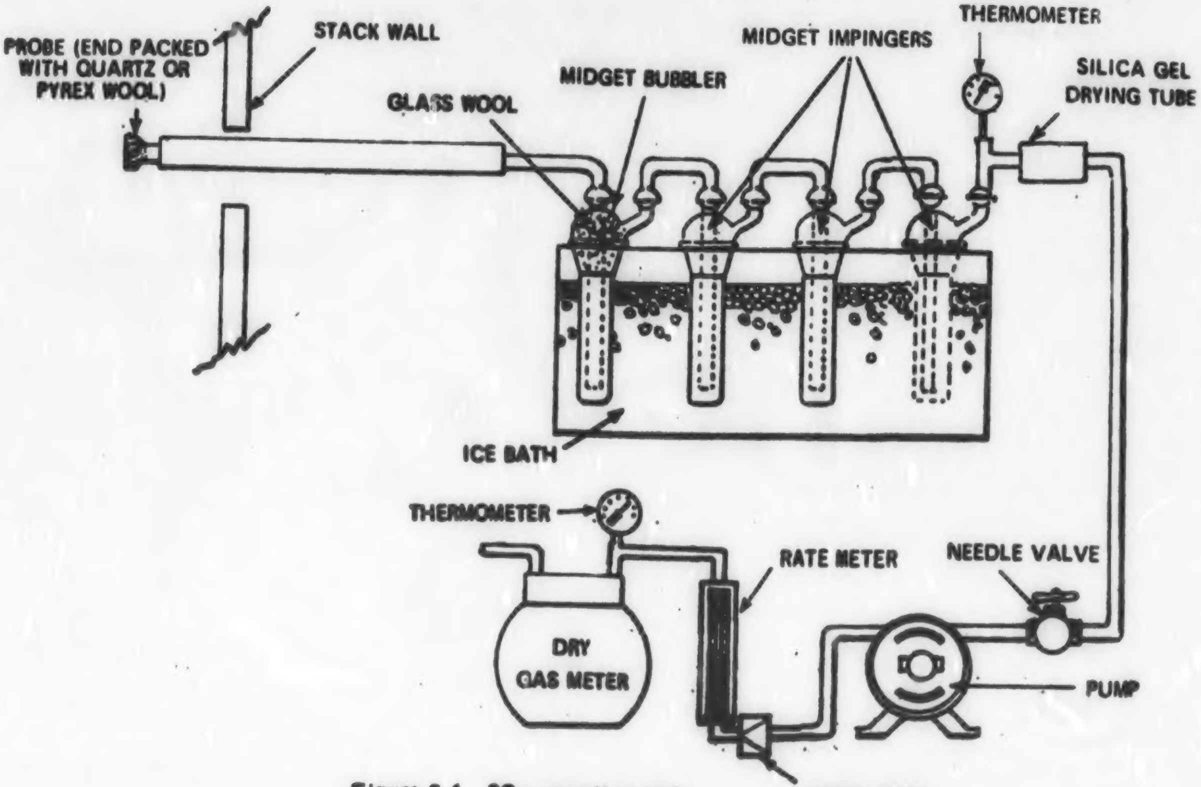

Figure 6-1. SO_2 sampling train.

2.1 Sampling. The sampling train is shown in Figure 6-1, and component parts are discussed below. The tester has the option of substituting sampling equipment described in Method 8 in place of the midget impinger equipment of Method 6. However, the Method 8 train must be modified to include a heated filter between the probe and isopropanol impinger, and the operation of the sampling train and sample analysis must be at the flow rates and solution volumes defined in Method 8.

The tester also has the option of determining SO_2 simultaneously with particulate matter and moisture determinations by (1) replacing the water in a Method 5 impinger system with 3 percent peroxide solution, or (2) by replacing the Method 5 water impinger system with a Method 8 isopropanol-filter-peroxide system. The analysis for SO_2 must be consistent with the procedure in Method 8.

2.1.1 Probe. Borosilicate glass, or stainless steel (other materials of construction may be used, subject to the approval of the Administrator), approximately 6-mm inside diameter, with a heating system to prevent water condensation and a filter (either in-stack or heated out-stack) to remove particulate matter, including sulfuric acid mist. A plug of glass wool is a satisfactory filter.

2.1.2 Bubbler and Impingers. One midget bubbler, with medium-coarse glass frit and borosilicate or quartz glass wool packed in top (see Figure 6-1) to prevent sulfuric acid mist carryover, and three 30-ml midget impingers. The bubbler and midget impingers must be connected in series with leak-free glass connectors. Silicone grease may be used, if necessary, to prevent leakage.

At the option of the tester, a midget impinger may be used in place of the midget bubbler.

Other collection absorbers and flow rates may be used, but are subject to the approval of the Administrator. Also, collection efficiency must be shown to be at least 99 percent for each test run and must be documented in the report. If the efficiency is found to be acceptable after a series of three tests, further documentation is not required. To conduct the efficiency test, an extra absorber must be added and analyzed separately. This extra absorber must not contain more than 1 percent of the total SO_2.

2.1.3 Glass Wool. Borosilicate or quartz.

2.1.4 Stopcock Grease. Acetone-insoluble, heat-stable silicone grease may be used, if necessary.

2.1.5 Temperature Gauge. Dial thermometer, or equivalent, to measure temperature of gas leaving impinger train to within 1° C (2° F.)

2.1.6 Drying Tube. Tube packed with 6- to 16-mesh indicating type silica gel, or equivalent, to dry the gas sample and to protect the meter and pump. If the silica gel has been used previously, dry at 175° C (350° F) for 2 hours. New silica gel may be used as received. Alternatively, other types of desiccants (equivalent or better) may be used, subject to approval of the Administrator.

2.1.7 Valve. Needle valve, to regulate sample gas flow rate.

2.1.8 Pump. Leak-free diaphragm pump, or equivalent, to pull gas through the train. Install a small tank between the pump and rate meter to eliminate the pulsation effect of the diaphragm pump on the rotameter.

2.1.9 Rate Meter. Rotameter, or equivalent, capable of measuring flow rate to within 2 percent of the selected flow rate of about 1000 cc/min.

2.1.10 Volume Meter. Dry gas meter, sufficiently accurate to measure the sample volume within 2 percent, calibrated at the selected flow rate and conditions actually encountered during sampling, and equipped with a temperature gauge (dial thermometer, or equivalent) capable of measuring temperature to within 3° C (5.4° F).

2.1.11 Barometer. Mercury, aneroid, or other barometer capable of measuring atmospheric pressure to within 2.5 mm Hg (0.1 in. Hg). In many cases, the barometric reading may be obtained from a nearby national weather service station, in which case the station value (which is the absolute barometric pressure) shall be requested and an adjustment for elevation differences between the weather station and sampling point shall be applied at a rate of minus 2.5 mm Hg (0.1 in. Hg) per 30 m (100 ft) elevation increase or vice versa for elevation decrease.

2.1.12 Vacuum Gauge. At least 760 mm Hg (30 in. Hg) gauge, to be used for leak check of the sampling train.

2.2 Sample Recovery.

2.2.1 Wash bottles. Polyethylene or glass, 500 ml, two.

2.2.2 Storage Bottles. Polyethylene, 100 ml, to store impinger samples (one per sample).

2.3 Analysis.

2.3.1 Pipettes. Volumetric type, 5-ml, 20-ml (one per sample), and 25-ml sizes.

2.3.2 Volumetric Flasks. 100-ml size (one per sample) and 1000-ml size.

2.3.3 Burettes. 5- and 50-ml sizes.

2.3.4 Erlenmeyer Flasks. 250 ml-size (one for each sample, blank, and standard).

2.3.5 Dropping Bottle. 125-ml size, to add indicator.

2.3.6 Graduated Cylinder. 100-ml size.

2.3.7 Spectrophotometer. To measure absorbance at 352 nanometers.

3. *Reagents*

Unless otherwise indicated, all reagents must conform to the specifications established by the Committee on Analytical Reagents of the American Chemical Society. Where such specifications are not available, use the best available grade.

3.1 Sampling.

3.1.1 Water. Deionized, distilled to conform to ASTM specification D1193-74, Type 3. At the option of the analyst, the $KMnO_4$ test for oxidizable organic matter may be omitted when high concentrations of organic matter are not expected to be present.

3.1.2 Isopropanol, 80 percent. Mix 80 ml of isopropanol with 20 ml of deionized, distilled water. Check each lot of isopropanol for peroxide impurities as follows: shake 10 ml of isopropanol with 10 ml of freshly prepared 10 percent potassium iodide solution. Prepare a blank by similarly treating 10 ml of distilled water. After 1 minute, read the absorbance at 352 nanometers on a spectrophotometer. If absorbance exceeds 0.1, reject alcohol for use.

Peroxides may be removed from isopropanol by redistilling or by passage through a column of activated alumina; however, reagent grade isopropanol with suitably low peroxide levels may be obtained from commercial sources. Rejection of contaminated lots may, therefore, be a more efficient procedure.

3.1.3 Hydrogen Peroxide, 3 Percent. Dilute 30 percent hydrogen peroxide 1:9 (v/v) with deionized, distilled water (30 ml is needed per sample). Prepare fresh daily.

3.1.4 Potassium Iodide Solution, 10 Percent. Dissolve 10.0 grams KI in deionized, distilled water and dilute to 100 ml. Prepare when needed.

3.2 Sample Recovery.

3.2.1 Water. Deionized, distilled, as in 3.1.1.

3.2.2 Isopropanol, 80 Percent. Mix 80 ml of isopropanol with 20 ml of deionized, distilled water.

3.3 Analysis.

3.3.1 Water. Deionized, distilled, as in 3.1.1.

3.3.2 Isopropanol, 100 percent.

3.3.3 Thorin Indicator. 1-(o-arsonophenylazo)-2-naphthol-3,6-disulfonic acid, disodium salt, or equivalent. Dissolve 0.20 g in 100 ml of deionized, distilled water.

3.3.4 Barium Perchlorate Solution, 0.0100 N. Dissolve 1.95 g of barium perchlorate trihydrate $[Ba(ClO_4)_2 \cdot 3H_2O]$ in 200 ml distilled water and dilute to 1 liter with isopropanol. Alternatively, 1.22 g of $[BaCl_2 \cdot 2H_2O]$ may be used instead of the perchlorate. Standardize as in Section 5.5.

3.3.5 Sulfuric Acid Standard, 0.0100 N. Purchase or standardize to ±0.0002 N against 0.0100 N NaOH which has previously been standardized against potassium acid phthalate (primary standard grade).

4. *Procedure.*

4.1 Sampling.

4.1.1 Preparation of collection train. Measure 15 ml of 80 percent isopropanol into the midget bubbler and 15 ml of 3 percent hydrogen peroxide into each of the first two midget impingers. Leave the final midget impinger dry. Assemble the train as shown in Figure 6-1. Adjust probe heater to a temperature sufficient to prevent water condensation. Place crushed ice and water around the impingers.

4.1.2 Leak-check procedure. A leak check prior to the sampling run is optional; however, a leak check after the sampling run is mandatory. The leak-check procedure is as follows:

With the probe disconnected, place a vacuum gauge at the inlet to the bubbler and pull a vacuum of 250 mm (10 in.) Hg; plug or pinch off the outlet of the flow meter, and then turn off the pump. The vacuum shall remain stable for at least 30 seconds. Carefully release the vacuum gauge before releasing the flow meter end to prevent back flow of the impinger fluid.

Other leak-check procedures may be used, subject to the approval of the Administrator, U.S. Environmental Protection Agency. The procedure used in Method 5 is not suitable for diaphragm pumps.

4.1.3 Sample collection. Record the initial dry gas meter reading and barometric pressure. To begin sampling, position the tip of the probe at the sampling point, connect the probe to the bubbler, and start the pump. Adjust the sample flow to a constant rate of approximately 1.0 liter/min as indicated by the rotameter. Maintain this constant rate (±10 percent) during the entire sampling run. Take readings (dry gas meter, temperatures at dry gas meter and at impinger outlet and rate meter) at least every 5 minutes. Add more ice during the run to keep the temperature of the gases leaving the last impinger at 20° C (68° F) or less. At the conclusion of each run, turn off the pump, remove probe from the stack, and record the final readings. Conduct a leak check as in Section 4.1.2. (This leak check is mandatory.) If a leak is found, void the test run. Drain the ice bath, and purge the remaining part of the train by drawing clean ambient air through the system for 15 minutes at the sampling rate.

Clean ambient air can be provided by passing air through a charcoal filter or through an extra midget impinger with 15 ml of 3 percent H_2O_2. The tester may opt to simply use ambient air, without purification.

4.2 Sample Recovery. Disconnect the impingers after purging. Discard the contents of the midget bubbler. Pour the contents of the midget impingers into a leak-free polyethylene bottle for shipment. Rinse the three midget impingers and the connecting tubes with deionized, distilled water, and add the washings to the same storage container. Mark the fluid level. Seal and identify the sample container.

4.3 Sample Analysis. Note level of liquid in container, and confirm whether any sample was lost during shipment; note this on analytical data sheet. If a noticeable amount of leakage has occurred, either void the sample or use methods, subject to the approval of the Administrator, to correct the final results.

Transfer the contents of the storage container to a 100-ml volumetric flask and dilute to exactly 100 ml with deionized, distilled water. Pipette a 20-ml aliquot of this solution into a 250-ml Erlenmeyer flask, add 80 ml of 100 percent isopropanol and two to four drops of thorin indicator, and titrate to a pink endpoint using 0.0100 N barium perchlorate. Repeat and average the titration volumes. Run a blank with each series of samples. Replicate titrations must agree within 1 percent or 0.2 ml, whichever is larger.

(NOTE.—Protect the 0.0100 N barium perchlorate solution from evaporation at all times.)

5. *Calibration*

5.1 Metering System.

5.1.1 Initial Calibration. Before its initial use in the field, first leak check the metering system (drying tube, needle valve, pump, rotameter, and dry gas meter) as follows: place a vacuum gauge at the inlet to the drying tube and pull a vacuum of 250 mm (10 in.) Hg; plug or pinch off the outlet or the flow meter, and then turn off the pump. The vacuum shall remain stable for at least 30 seconds. Carefully release the vacuum gauge before releasing the flow meter end.

Next, calibrate the metering system (at the sampling flow rate specified by the method) as follows: connect an appropriately sized wet test meter (e.g., 1 liter per revolution) to the inlet of the drying tube. Make three independent calibration runs, using at least five revolutions of the dry gas meter per run. Calculate the calibration factor, Y (wet test meter calibration volume divided by the dry gas meter volume, both volumes adjusted to the same reference temperature and pressure), for each run, and average the results. If any Y value deviates by more than 2 percent from the average, the metering system is unacceptable for use. Otherwise, use the average as the calibration factor for subsequent test runs.

5.1.2 Post-Test Calibration Check. After each field test series, conduct a calibration check as in Section 5.1.1 above, except for the following variations: (a) the leak check is not to be conducted, (b) three, or more revolutions of the dry gas meter may be used, and (c) only two independent runs need be made. If the calibration factor does not deviate by more than 5 percent from the initial calibration factor (determined in Section 5.1.1), then the dry gas meter volumes obtained during the test series are acceptable. If the calibration factor deviates by more than 5 percent, recalibrate the metering system as in Section 5.1.1, and for the calculations, use the calibration factor (initial or recalibration) that yields the lower gas volume for each test run.

5.2 Thermometers. Calibrate against mercury-in-glass thermometers.

5.3 Rotameter. The rotameter need not be calibrated but should be cleaned and maintained according to the manufacturer's instruction.

5.4 Barometer. Calibrate against a mercury barometer.

5.5 Barium Perchlorate Solution. Standardize the barium perchlorate solution against 25 ml of standard sulfuric acid to which 100 ml of 100 percent isopropanol has been added.

6. *Calculations*

Carry out calculations, retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after final calculation.

6.1 Nomenclature.

C_{SO_2} = Concentration of sulfur dioxide, dry basis corrected to standard conditions, mg/dscm (lb/dscf).

N = Normality of barium perchlorate titrant, milliequivalents/ml.

P_{bar} = Barometric pressure at the exit orifice of the dry gas meter, mm Hg (in. Hg).

P_{std} = Standard absolute pressure, 760 mm Hg (29.92 in. Hg).

T_m = Average dry gas meter absolute temperature, °K (°R).

T_{std} = Standard absolute temperature, 293° K (528° R).

V_a = Volume of sample aliquot titrated, ml.

V_m = Dry gas volume as measured by the dry gas meter, dcm (dcf).

$V_{m(std)}$ = Dry gas volume measured by the dry gas meter, corrected to standard conditions, dscm (dscf).

V_{soln} = Total volume of solution in which the sulfur dioxide sample is contained, 100 ml.

V_t = Volume of barium perchlorate titrant used for the sample, ml (average of replicate titrations).

V_{tb} = Volume of barium perchlorate titrant used for the blank, ml.

Y = Dry gas meter calibration factor.

32.03 = Equivalent weight of sulfur dioxide.

6.2 Dry sample gas volume, corrected to standard conditions.

$$V_{m(std)} = V_m Y \left(\frac{T_{std}}{T_m}\right)\left(\frac{P_{bar}}{P_{std}}\right) = K_1 Y \frac{V_m P_{bar}}{T_m}$$

Equation 6-1

where:

K_1 = 0.3858 °K/mm Hg for metric units.
= 17.64 °R/in. Hg for English units.

6.3 Sulfur dioxide concentration.

$$C_{SO_2} = K_2 \frac{(V_t - V_{tb})\, N\left(\frac{V_{soln}}{V_a}\right)}{V_{m(std)}}$$

Equation 6-2

where:

K_2 = 32.03 mg/meq. for metric units.
= 7.061×10⁻⁵ lb/meq. for English units.

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METHOD 7—DETERMINATION OF NITROGEN OXIDE EMISSIONS FROM STATIONARY SOURCES

1. *Principle and Applicability*

1.1 Principle. A grab sample is collected in an evacuated flask containing a dilute sulfuric acid-hydrogen peroxide absorbing solution, and the nitrogen oxides, except nitrous oxide, are measured colorimetrically using the phenoldisulfonic acid (PDS) procedure.

1.2 Applicability. This method is applicable to the measurement of nitrogen oxides emitted from stationary sources. The range of the method has been determined to be 2 to 400 milligrams NO_x (as NO_2) per dry standard cubic meter, without having to dilute the sample.

2. *Apparatus*

2.1 Sampling (see Figure 7-1). Other grab sampling systems or equipment, capable of measuring sample volume to within ±2.0 percent and collecting a sufficient sample volume to allow analytical reproducibility to within ±5 percent, will be considered acceptable alternatives, subject to approval of the Administrator, U.S. Environmental Protection Agency. The following equipment is used in sampling:

2.1.1 Probe. Borosilicate glass tubing, sufficiently heated to prevent water condensation and equipped with an in-stack or out-stack filter to remove particulate matter (a plug of glass wool is satisfactory for this purpose). Stainless steel or Teflon[1] tubing may also be used for the probe. Heating is not necessary if the probe remains dry during the purging period.

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[1] Mention of trade names or specific products does not constitute endorsement by the Environmental Protection Agency.

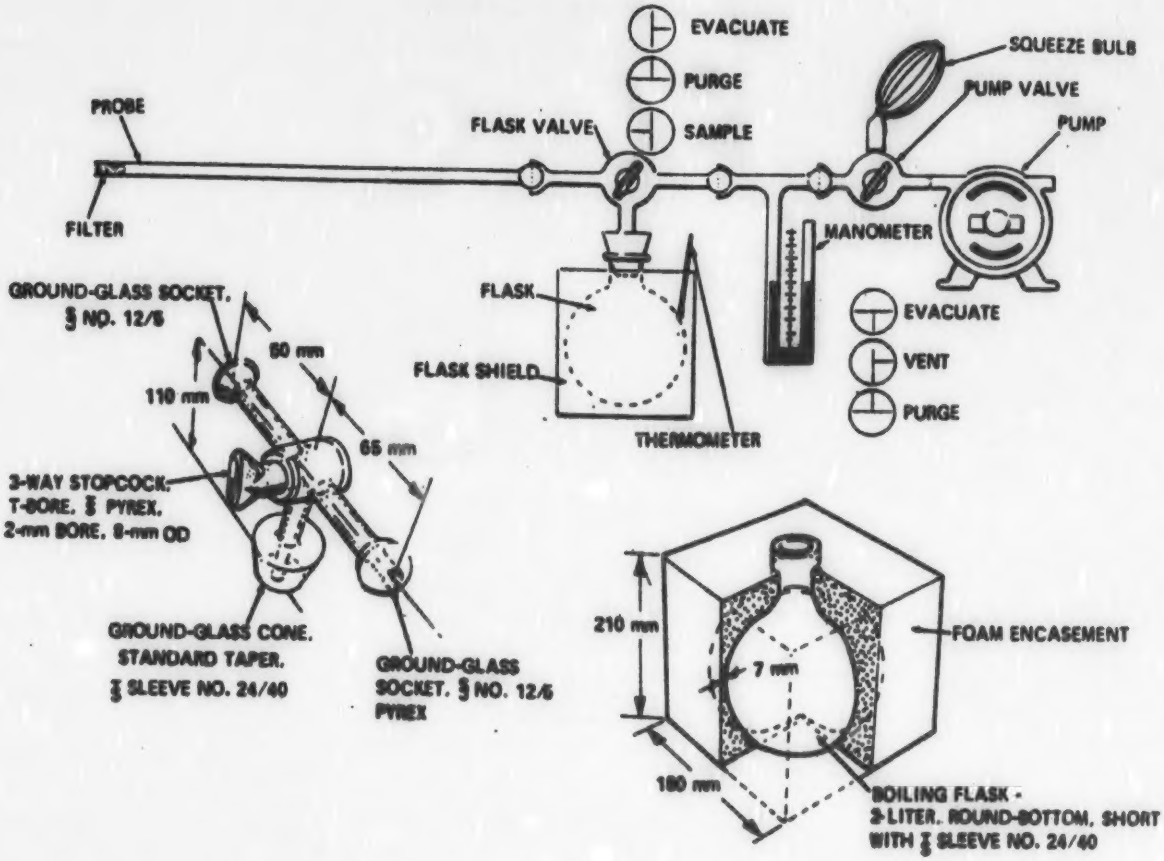
EVACUATE
PURGE
SAMPLE
SQUEEZE BULB
PUMP VALVE
PUMP
PROBE
FLASK VALVE
FILTER
MANOMETER
FLASK
FLASK SHIELD
THERMOMETER
EVACUATE
VENT
PURGE
GROUND-GLASS SOCKET, § NO. 12/5
50 mm
110 mm
65 mm
3-WAY STOPCOCK, T-BORE, § PYREX, 2-mm BORE, 8-mm OD
GROUND-GLASS CONE, STANDARD TAPER, § SLEEVE NO. 24/40
GROUND-GLASS SOCKET, § NO. 12/5 PYREX
210 mm
7 mm
FOAM ENCASEMENT
190 mm
BOILING FLASK - 2-LITER, ROUND-BOTTOM, SHORT NECK, WITH § SLEEVE NO. 24/40

Figure 7-1. Sampling train, flask valve, and flask.

2.1.2 Collection Flask. Two-liter borosilicate, round bottom flask, with short neck and 24/40 standard taper opening, protected against implosion or breakage.

2.1.3 Flask Valve. T-bore stopcock connected to a 24/40 standard taper joint.

2.1.4 Temperature Gauge. Dial-type thermometer, or other temperature gauge, capable of measuring 1° C (2° F) intervals from −5 to 50° C (25 to 125° F).

2.1.5 Vacuum Line. Tubing capable of withstanding a vacuum of 75 mm Hg (3 in. Hg) absolute pressure, with "T" connection and T-bore stopcock.

2.1.6 Vacuum Gauge. U-tube manometer, 1 meter (36 in.), with 1-mm (0.1-in.) divisions, or other gauge capable of measuring pressure to within ±2.5 mm Hg (0.10 in. Hg).

2.1.7 Pump. Capable of evacuating the collection flask to a pressure equal to or less than 75 mm Hg (3 in. Hg) absolute.

2.1.8 Squeeze Bulb. One-way.

2.1.9 Volumetric Pipette. 25 ml.

2.1.10 Stopcock and Ground Joint Grease. A high-vacuum, high-temperature chlorofluorocarbon grease is required. Halocarbon 25-5S has been found to be effective.

2.1.11 Barometer. Mercury, aneroid, or other barometer capable of measuring atmospheric pressure to within 2.5 mm Hg (0.1 in. Hg). In many cases, the barometric reading may be obtained from a nearby national weather service station, in which case the station value (which is the absolute barometric pressure) shall be requested and an adjustment for elevation differences between the weather station and sampling point shall be applied at a rate of minus 2.5 mm Hg (0.1 in. Hg) per 30 m (100 ft) elevation increase, or vice versa for elevation decrease.

2.2 Sample Recovery. The following equipment is required for sample recovery:

2.2.1 Graduated Cylinder. 50 ml with 1-ml divisions.

2.2.2 Storage Containers. Leak-free polyethylene bottles.

2.2.3 Wash Bottle. Polyethylene or glass.

2.2.4 Glass Stirring Rod.

2.2.5 Test Paper for Indicating pH. To cover the pH range of 7 to 14.

2.3 Analysis. For the analysis, the following equipment is needed:

2.3.1 Volumetric Pipettes. Two 1 ml, two 2 ml, one 3 ml, one 4 ml, two 10 ml, and one 25 ml for each sample and standard.

2.3.2 Porcelain Evaporating Dishes. 175- to 250-ml capacity with lip for pouring, one for each sample and each standard. The Coors No. 45006 (shallow-form, 195 ml) has been found to be satisfactory. Alternatively, polymethyl pentene beakers (Nalge No. 1203, 150 ml), or glass beakers (150 ml) may be used. When glass beakers are used, etching of the beakers may cause solid matter to be present in the analytical step; the solids should be removed by filtration (see Section 4.3).

2.3.3 Steam Bath. Low-temperature ovens or thermostatically controlled hot plates kept below 70° C (160° F) are acceptable alternatives.

2.3.4 Dropping Pipette or Dropper. Three required.

2.3.5 Polyethylene Policeman. One for each sample and each standard.

2.3.6 Graduated Cylinder. 100 ml with 1-ml divisions.

2.3.7 Volumetric Flasks. 50 ml (one for each sample), 100 ml (one for each sample and each standard, and one for the working standard KNO_3 solution), and 1000 ml (one).

2.3.8 Spectrophotometer. To measure absorbance at 410 nm.

2.3.9 Graduated Pipette. 10 ml with 0.1-ml divisions.

2.3.10 Test Paper for Indicating pH. To cover the pH range of 7 to 14.

2.3.11 Analytical Balance. To measure to within 0.1 mg.

3. *Reagents*

Unless otherwise indicated, it is intended that all reagents conform to the specifications established by the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available; otherwise, use the best available grade.

3.1 Sampling. To prepare the absorbing solution, cautiously add 2.8 ml concentrated H_2SO_4 to 1 liter of deionized, distilled water. Mix well and add 6 ml of 3 percent hydrogen peroxide, freshly prepared from 30 percent hydrogen peroxide solution. The absorbing solution should be used within 1 week of its preparation. Do not expose to extreme heat or direct sunlight.

3.2 Sample Recovery. Two reagents are required for sample recovery:

3.2.1 Sodium Hydroxide (1N). Dissolve 40 g NaOH in deionized, distilled water and dilute to 1 liter.

3.2.2 Water. Deionized, distilled to conform to ASTM specification D1193-74, Type 3. At the option of the analyst, the $KMNO_4$ test for oxidizable organic matter may be omitted when high concentrations of organic matter are not expected to be present.

3.3 Analysis. For the analysis, the following reagents are required:

3.3.1 Fuming Sulfuric Acid. 15 to 18 percent by weight free sulfur trioxide. HANDLE WITH CAUTION.

3.3.2 Phenol. White solid.

3.3.3 Sulfuric Acid. Concentrated, 95 percent minimum assay. HANDLE WITH CAUTION.

3.3.4 Potassium Nitrate. Dried at 105 to 110° C (220 to 230° F) for a minimum of 2 hours just prior to preparation of standard solution.

3.3.5 Standard KNO_3 Solution. Dissolve exactly 2.198 g of dried potassium nitrate (KNO_3) in deionized, distilled water and dilute to 1 liter with deionized, distilled water in a 1,000-ml volumetric flask.

3.3.6 Working Standard KNO_3 Solution. Dilute 10 ml of the standard solution to 100 ml with deionized distilled water. One milliliter of the working standard solution is equivalent to 100 μg nitrogen dioxide (NO_2).

3.3.7 Water. Deionized, distilled as in Section 3.2.2.

3.3.8 Phenoldisulfonic Acid Solution. Dissolve 25 g of pure white phenol in 150 ml concentrated sulfuric acid on a steam bath. Cool, add 75 ml fuming sulfuric acid, and heat at 100° C (212° F) for 2 hours. Store in a dark, stoppered bottle.

4. *Procedures*

4.1 Sampling.

4.1.1 Pipette 25 ml of absorbing solution into a sample flask, retaining a sufficient quantity for use in preparing the calibration standards. Insert the flask valve stopper into the flask with the valve in the "purge" position. Assemble the sampling train as shown in Figure 7-1 and place the probe at the sampling point. Make sure that all fittings are tight and leak-free, and that all ground glass joints have been properly greased with a high-vacuum, high-temperature chlorofluorocarbon-based stopcock grease. Turn the flask valve and the pump valve to their "evacuate" positions. Evacuate the flask to 75 mm Hg (3 in. Hg) absolute pressure, or less. Evacuation to a pressure approaching the vapor pressure of water at the existing temperature is desirable. Turn the pump valve to its "vent" position and turn off the pump. Check for leakage by observing the manometer for any pressure fluctuation. (Any variation greater than 10 mm Hg (0.4 in. Hg) over a period of 1 minute is not acceptable, and the flask is not to be used until the leakage problem is corrected. Pressure in the flask is not to exceed 75 mm Hg (3 in. Hg) absolute at the time sampling is commenced.) Record the volume of the flask and valve (V_f), the flask temperature (T_i), and the barometric pressure. Turn the flask valve counterclockwise to its "purge" position and do the same with the pump valve. Purge the probe and the vacuum tube using the squeeze bulb. If condensation occurs in the probe and the flask valve area, heat the probe and purge until the condensation disappears. Next, turn the pump valve to its "vent" position. Turn the flask valve clockwise to its "evacuate" position and record the difference in the mercury levels in the manometer. The absolute internal pressure in the flask (P_i) is equal to the barometric pressure less the manometer reading. Immediately turn the flask valve to the "sample" position and permit the gas to enter the flask until pressures in the flask and sample line (i.e., duct, stack) are equal. This will usually require about 15 seconds; a longer period indicates a "plug" in the probe, which must be corrected before sampling is continued. After collecting the sample, turn the flask valve to its "purge" position and disconnect the flask from the sampling train. Shake the flask for at least 5 minutes.

4.1.2 If the gas being sampled contains insufficient oxygen for the conversion of NO to NO_2 (e.g., an applicable subpart of the standard may require taking a sample of a calibration gas mixture of NO in N_2), then oxygen shall be introduced into the flask to permit this conversion. Oxygen may be introduced into the flask by one of three methods; (1) Before evacuating the sampling flask, flush with pure cylinder oxygen, then evacuate flask to 75 mm Hg (3 in. Hg) absolute pressure, or less; or (2) inject oxygen into the flask after sampling; or (3) terminate sampling with a minimum of 50 mm Hg (2 in. Hg) vacuum remaining in the flask, record this final pressure, and then vent the flask to the atmosphere until the flask pressure is almost equal to atmospheric pressure.

4.2 Sample Recovery. Let the flask set for a minimum of 16 hours and then shake the contents for 2 minutes. Connect the flask to a mercury filled U-tube manometer. Open the valve from the flask to the manometer and record the flask temperature (T_f), the barometric pressure, and the difference between the mercury levels in the manometer. The absolute internal pressure in the flask (P_f) is the barometric pressure less the manometer reading. Transfer the contents of the flask to a leak-free polyethylene bottle. Rinse the flask twice with 5-ml portions of deionized, distilled water and add the rinse water to the bottle. Adjust the pH to between 9 and 12 by adding sodium hydroxide (1 N), dropwise (about 25 to 35 drops). Check the pH by dipping a stirring rod into the solution and then touching the rod to the pH test paper. Remove as little material as possible during this step. Mark the height of the liquid level so that the container can be checked for leakage after transport. Label the container to clearly identify its contents. Seal the container for shipping.

4.3 Analysis. Note the level of the liquid in container and confirm whether or not any sample was lost during shipment; note this on the analytical data sheet. If a noticeable amount of leakage has occurred, either void the sample or use methods, subject to the approval of the Administrator, to correct the final results. Immediately prior to analysis, transfer the contents of the shipping container to a 50-ml volumetric flask, and rinse the container twice with 5-ml portions of deionized, distilled water. Add the rinse water to the flask and dilute to the mark with deionized, distilled water; mix thoroughly. Pipette a 25-ml aliquot into the procelain evaporating dish. Return any unused portion of the sample to the polyethylene storage bottle. Evaporate the 25-ml aliquot to dryness on a steam bath and allow to cool. Add 2 ml phenoldisulfonic acid solution to the dried residue and triturate thoroughly with a polyethylene policeman. Make sure the solution contacts all the residue. Add 1 ml deionized, distilled water and four drops of concentrated sulfuric acid. Heat the solution on a steam bath for 3 minutes with occasional stirring. Allow the solution to cool, add 20 ml deionized, distilled water, mix well by stirring, and add concentrated ammonium hydroxide, dropwise, with constant stirring, until the pH is 10 (as determined by pH paper). If the sample contains solids, these must be removed by filtration (centrifugation is an acceptable alternative, subject to the approval of the Administrator), as follows: filter through Whatman No. 41 filter paper into a 100-ml volumetric flask; rinse the evaporating dish with three 5-ml portions of deionized, distilled water; filter these three rinses. Wash the filter with at least three 15-ml portions of deionized, distilled water. Add the filter washings to the contents of the volumetric flask and dilute to the mark with deionized, distilled water. If solids are absent, the solution can be transferred directly to the 100-ml volumetric flask and diluted to the mark with deionized, distilled water. Mix the contents of the flask thoroughly, and measure the absorbance at the optimum wavelength used for the standards (Section 5.2.1), using the blank solution as a zero reference. Dilute the sample and the blank with equal volumes of deionized, distilled water if the absorbance exceeds A_4, the absorbance of the 400 µg NO_2 standard (see Section 5.2.2).

5. Calibration

5.1 Flask Volume. The volume of the collection flask-flask valve combination must be known prior to sampling. Assemble the flask and flask valve and fill with water, to the stopcock. Measure the volume of water to ±10 ml. Record this volume on the flask.

5.2 Spectrophotometer Calibration.

5.2.1 Optimum Wavelength Determination. For both fixed and variable wavelength spectrophotometers, calibrate against standard certified wavelength of 410 nm, every 6 months. Alternatively, for variable wave length spectrophotometers, scan the spectrum between 400 and 415 nm using a 200 µg NO_2 standard solution (see Section 5.2.2). If a peak does not occur, the spectrophotometer is probably malfunctioning, and should be repaired. When a peak is obtained within the 400 to 415 nm range, the wavelength at which this peak occurs shall be the optimum wavelength for the measurement of absorbance for both the standards and samples.

5.2.2 Determination of Spectrophotometer Calibration Factor K_c. Add 0.0, 1.0, 2.0, 3.0, and 4.0 ml of the KNO_3 working standard solution (1 ml=100 µg NO_2) to a series of five porcelain evaporating dishes. To each, add 25 ml of absorbing solution, 10 ml deionized, distilled water, and sodium hydroxide (1N), dropwise, until the pH is between 9 and 12 (about 25 to 35 drops each). Beginning with the evaporation step, follow the analysis procedure of Section 4.3, until the solution has been transferred to the 100 ml volumetric flask and diluted to the mark. Measure the absorbance of each solution, at the optimum wavelength, as determined in Section 5.2.1. This calibration procedure must be repeated on each day that samples are analyzed. Calculate the spectrophotometer calibration factor as follows:

$$K_c = 100\,\frac{A_1+2A_2+3A_3+4A_4}{A_1^2+A_2^2+A_3^2+A_4^2}$$

Equation 7-1

where:

K_c=Calibration factor
A_1=Absorbance of the 100-µg NO_2 standard
A_2=Absorbance of the 200-µg NO_2 standard
A_3=Absorbance of the 300-µg NO_2 standard
A_4=Absorbance of the 400-µg NO_2 standard

5.3 Barometer. Calibrate against a mercury barometer.

5.4 Temperature Gauge. Calibrate dial thermometers against mercury-in-glass thermometers.

5.5 Vacuum Gauge. Calibrate mechanical gauges, if used, against a mercury manometer such as that specified in 2.1.6.

5.6 Analytical Balance. Calibrate against standard weights.

6. Calculations

Carry out the calculations, retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after final calculations.

6.1 Nomenclature.

A=Absorbance of sample.
C=Concentration of NO_x as NO_2, dry basis, corrected to standard conditions, mg/dscm (lb/dscf).
F=Dilution factor (i.e., 25/5, 25/10, etc., required only if sample dilution was needed to reduce the absorbance into the range of calibration).
K_c=Spectrophotometer calibration factor.
m=Mass of NO_x as NO_2 in gas sample, µg.
P_f=Final absolute pressure of flask, mm Hg (in. Hg).
P_i=Initial absolute pressure of flask, mm Hg (in. Hg).
P_{std}=Standard absolute pressure, 760 mm Hg (29.92 in. Hg).
T_f=Final absolute temperature of flask, °K (°R).
T_i=Initial absolute temperature of flask, °K (°R).
T_{std}=Standard absolute temperature, 293° K (528° R)
V_{sc}=Sample volume at standard conditions (dry basis), ml.
V_f=Volume of flask and valve, ml.
V_a=Volume of absorbing solution, 25 ml.
2=50/25, the aliquot factor. (If other than a 25-ml aliquot was used for analysis, the corresponding factor must be substituted).

6.2 Sample volume, dry basis, corrected to standard conditions.

$$V_{sc}=\frac{T_{std}}{P_{std}}\,(V_f-V_a)\left[\frac{P_f}{T_f}-\frac{P_i}{T_i}\right]$$

$$=K_1(V_f-25\text{ ml})\left[\frac{P_f}{T_f}-\frac{P_i}{T_i}\right]$$

Equation 7-2

where:

$$K_1=0.3858\,\frac{°\text{K}}{\text{mm Hg}}\text{ for metric units}$$

$$=17.64\,\frac{°\text{R}}{\text{in. Hg}}\text{ for English units}$$

6.3 Total µg NO_2 per sample.

$$m=2\,K_c\,AF$$

Equation 7-3

NOTE.—If other than a 25-ml aliquot is used for analysis, the factor 2 must be replaced by a corresponding factor.

6.4 Sample concentration, dry basis, corrected to standard conditions.

$$C=K_2\,\frac{m}{V_{sc}}$$

Equation 7-4

where:

$$K_2=10^3\,\frac{\text{mg/m}^3}{\mu\text{g/ml}}\text{ for metric units}$$

$$=6.243\times10^{-5}\,\frac{\text{lb/scf}}{\mu\text{g/ml}}\text{ for English units}$$

7. Bibliography

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METHOD 8—DETERMINATION OF SULFURIC ACID MIST AND SULFUR DIOXIDE EMISSIONS FROM STATIONARY SOURCES

1. Principle and Applicability

1.1 Principle. A gas sample is extracted isokinetically from the stack. The sulfuric acid mist (including sulfur trioxide) and the sulfur dioxide are separated, and both fractions are measured separately by the barium-thorin titration method.

1.2 Applicability. This method is applicable for the determination of sulfuric acid mist (including sulfur trioxide, and in the absence of other particulate matter) and sulfur dioxide emissions from stationary sources. Collaborative tests have shown that the minimum detectable limits of the method are 0.05 milligrams/cubic meter (0.03×10^{-7} pounds/cubic foot) for sulfur trioxide and 1.2 mg/m^3 ($0.74\ 10^{-7}$ lb/ft^3) for sulfur dioxide. No upper limits have been established. Based on theoretical calculations for 200 milliliters of 3 percent hydrogen peroxide solution, the upper concentration limit for sulfur dioxide in a 1.0 m^3 (35.3 ft^3) gas sample is about 12,500 mg/m^3 (7.7×10^{-4} lb/ft^3). The upper limit can be extended by increasing the quantity of peroxide solution in the impingers.

Possible interfering agents of this method are fluorides, free ammonia, and dimethyl aniline. If any of these interfering agents are present (this can be determined by knowledge of the process), alternative methods, subject to the approval of the Administrator, are required.

Filterable particulate matter may be determined along with SO_3 and SO_2 (subject to the approval of the Administrator); however, the procedure used for particulate matter must be consistent with the specifications and procedures given in Method 5.

2. Apparatus

2.1 Sampling. A schematic of the sampling train used in this method is shown in Figure 8-1; it is similar to the Method 5 train except that the filter position is different and the filter holder does not have to be heated. Commercial models of this train are available. For those who desire to build their own, however, complete construction details are described in APTD-0581. Changes from the APTD-0581 document and allowable modifications to Figure 8-1 are discussed in the following subsections.

The operating and maintenance procedures for the sampling train are described in APTD-[illegible]6. Since correct usage is important in obtaining valid results, all users should read the APTD-0576 document and adopt the operating and maintenance procedures outlined in it, unless otherwise specified herein. Further details and guidelines on operation and maintenance are given in Method 5 and should be read and followed whenever they are applicable.

2.1.1 Probe Nozzle. Same as Method 5, Section 2.1.1.

2.1.2 Probe Liner. Borosilicate or quartz glass, with a heating system to prevent visible condensation during sampling. Do not use metal probe liners.

2.1.3 Pitot Tube. Same as Method 5, Section 2.1.3.

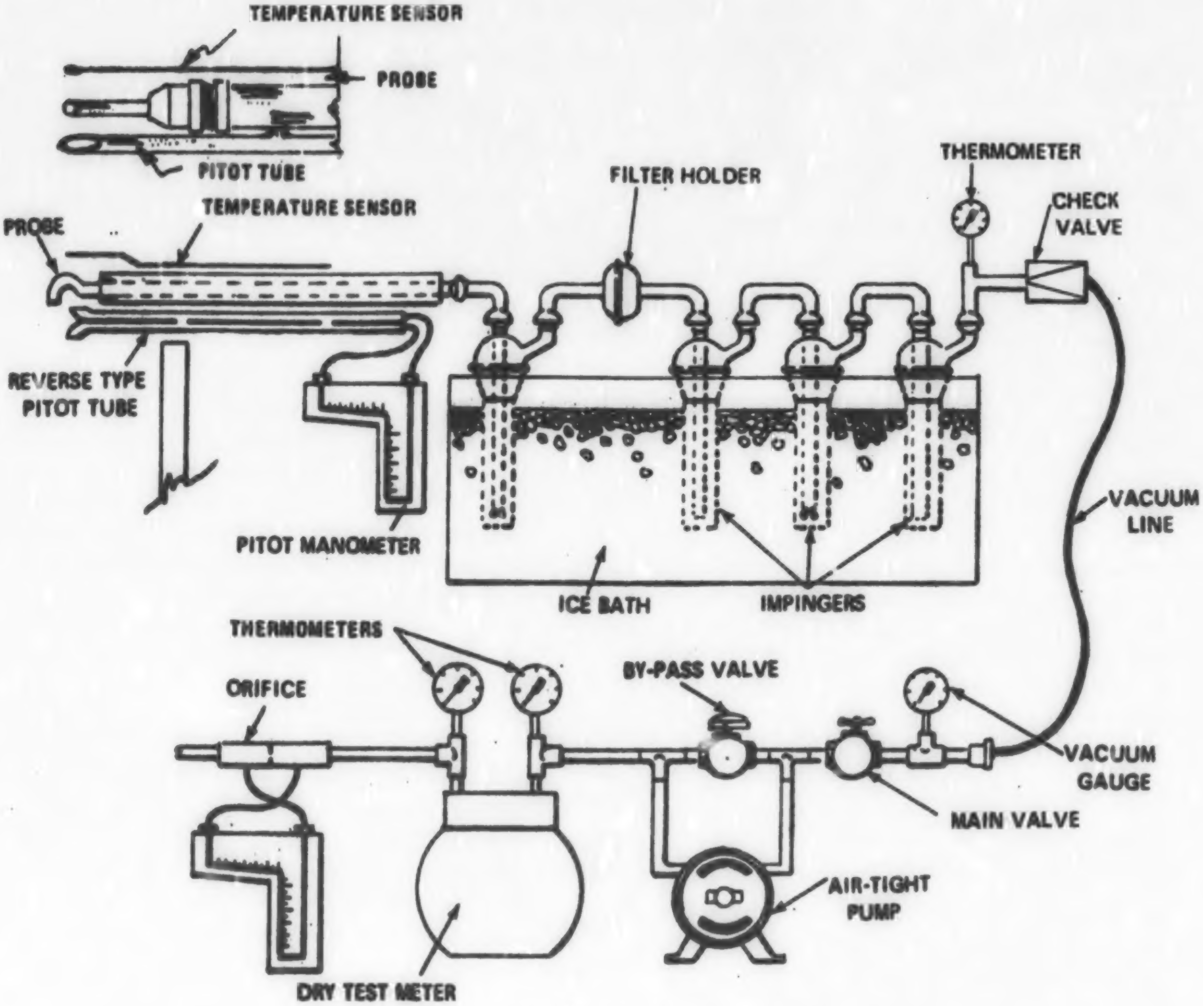

Figure 8-1. Sulfuric acid mist sampling train.

2.1.4 Differential Pressure Gauge. Same as Method 5, Section 2.1.4.

2.1.5 Filter Holder. Borosilicate glass, with a glass frit filter support and a silicone rubber gasket. Other gasket materials, e.g., Teflon or Viton, may be used subject to the approval of the Administrator. The holder design shall provide a positive seal against leakage from the outside or around the filter. The filter holder shall be placed between the first and second impingers. Note: Do not heat the filter holder.

2.1.6 Impingers—Four, as shown in Figure 8-1. The first and third shall be of the Greenburg-Smith design with standard tips. The second and fourth shall be of the Greenburg-Smith design, modified by replacing the insert with an approximately 13 millimeter (0.5 in.) ID glass tube, having an unconstricted tip located 13 mm (0.5 in.) from the bottom of the flask. Similar collection systems, which have been approved by the Administrator, may be used.

2.1.7 Metering System. Same as Method 5, Section 2.1.8.

2.1.8 Barometer. Same as Method 5, Section 2.1.9.

2.1.9 Gas Density Determination Equipment. Same as Method 5, Section 2.1.10.

2.1.10 Temperature Gauge. Thermometer, or equivalent, to measure the temperature of the gas leaving the impinger train to within 1° C (2° F).

2.2 Sample Recovery.

2.2.1 Wash Bottles. Polyethylene or glass, 500 ml. (two).

2.2.2 Graduated Cylinders. 250 ml, 1 liter. (Volumetric flasks may also be used.)

2.2.3 Storage Bottles. Leak-free polyethylene bottles, 1000 ml size (two for each sampling run).

2.2.4 Trip Balance. 500-gram capacity, to measure to ±0.5 g (necessary only if a moisture content analysis is to be done).

2.3 Analysis.

2.3.1 Pipettes. Volumetric 25 ml, 100 ml.

2.3.2 Burrette. 50 ml.

2.3.3 Erlenmeyer Flask. 250 ml. (one for each sample blank and standard).

2.3.4 Graduated Cylinder. 100 ml.

2.3.5 Trip Balance. 500 g capacity, to measure to ±0.5 g.

2.3.6 Dropping Bottle. To add indicator solution, 125-ml size.

3. Reagents

Unless otherwise indicated, all reagents are to conform to the specifications established by the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available. Otherwise, use the best available grade.

3.1 Sampling.

3.1.1 Filters. Same as Method 5, Section 3.1.1.

3.1.2 Silica Gel. Same as Method 5, Section 3.1.2.

3.1.3 Water. Deionized, distilled to conform to ASTM specification D1193-74, Type 3. At the option of the analyst, the $KMnO_4$ test for oxidizable organic matter may be omitted when high concentrations of organic matter are not expected to be present.

3.1.4 Isopropanol. 80 Percent. Mix 800 ml of isopropanol with 200 ml of deionized, distilled water.

NOTE.—Experience has shown that only A.C.S. grade isopropanol is satisfactory. Tests have shown that isopropanol obtained from commercial sources occasionally has peroxide impurities that will cause erroneously high sulfuric acid mist measurement. Use the following test for detecting peroxides in each lot of isopropanol: Shake 10 ml of the isopropanol with 10 ml of freshly prepared 10 percent potassium iodide solution. Prepare a blank by similarly treating 10 ml of distilled water. After 1 minute, read the absorbance on a spectrophotometer at 352 nanometers. If the absorbance exceeds 0.1, the isopropanol shall not be used. Peroxides may be removed from isopropanol by redistilling, or by passage through a column of activated alumina. However, reagent-grade isopropanol with suitably low peroxide levels is readily available from commercial sources; therefore, rejection of contaminated lots may be more efficient than following the peroxide removal procedure.

3.1.5 Hydrogen Peroxide, 3 Percent. Dilute 100 ml of 30 percent hydrogen peroxide to 1 liter with deionized, distilled water. Prepare fresh daily.

3.1.6 Crushed Ice.

3.2 Sample Recovery.

3.2.1 Water. Same as 3.1.3.

3.2.2 Isopropanol, 80 Percent. Same as 3.1.4.

3.3 Analysis.

3.3.1 Water. Same as 3.1.3.

3.3.2 Isopropanol, 100 Percent.

3.3.3 Thorin Indicator. 1-(o-arsonophenylazo)-2-naphthol-3, 6-disulfonic acid, disodium salt, or equivalent. Dissolve 0.20 g in 100 ml of deionized, distilled water.

3.3.4 Barium Perchlorate (0.0100 Normal). Dissolve 1.95 g of barium perchlorate trihydrate ($Ba(ClO_4)_2 \cdot 3H_2O$) in 200 ml deionized, distilled water, and dilute to 1 liter with isopropanol; 1.22 g of barium chloride dihydrate ($BaCl_2 \cdot 2H_2O$) may be used instead of the barium perchlorate. Standardize with sulfuric acid as in Section 5.2. This solution must be protected against evaporation at all times.

2.3.5 Sulfuric Acid Standard (0.0100 N). Purchase or standardize to ±0.0002 N against 0.0100 N NaOH that has previously been standardized against primary standard potassium acid phthalate.

4. *Procedure*

4.1 Sampling.

4.1.1 Pretest Preparation. Follow the procedure outlined in Method 5, Section 4.1.1; filters should be inspected, but need not be desiccated, weighed, or identified. If the effluent gas can be considered dry, i.e., moisture free, the silica gel need not be weighed.

4.1.2 Preliminary Determinations. Follow the procedure outlined in Method 5, Section 4.1.2.

4.1.3 Preparation of Collection Train. Follow the procedure outlined in Method 5, Section 4.1.3 (except for the second paragraph and other obviously inapplicable parts) and use Figure 8-1 instead of Figure 5-1. Replace the second paragraph with: Place 100 ml of 80 percent isopropanol in the first impinger, 100 ml of 3 percent hydrogen peroxide in both the second and third impingers; retain a portion of each reagent for use as a blank solution. Place about 200 g of silica gel in the fourth impinger.

NOTE.—If moisture content is to be determined by impinger analysis, weigh each of the first three impingers (plus absorbing solution) to the nearest 0.5 g and record these weights. The weight of the silica gel (or silica gel plus container) must also be determined to the nearest 0.5 g and recorded.

4.1.4 Pretest Leak-Check Procedure. Follow the basic procedure outlined in Method 5, Section 4.1.4.1, noting that the probe heater shall be adjusted to the minimum temperature required to prevent condensation, and also that verbage such as, "* * * plugging the inlet to the filter holder * * *," shall be replaced by, "* * * plugging the inlet to the first impinger * * *." The pretest leak-check is optional.

4.1.5 Train Operation. Follow the basic procedures outlined in Method 5, Section 4.1.5, in conjunction with the following special instructions. Data shall be recorded on a sheet similar to the one in Figure 8-2. The sampling rate shall not exceed 0.030 m³/min (1.0 cfm) during the run. Periodically during the test, observe the connecting line between the probe and first impinger for signs of condensation. If it does occur, adjust the probe heater setting upward to the minimum temperature required to prevent condensation. If component changes become necessary during a run, a leak-check shall be done immediately before each change, according to the procedure outlined in Section 4.1.4.2 of Method 5 (with appropriate modifications, as mentioned in Section 4.1.4 of this method); record all leak rates. If the leakage rate(s) exceed the specified rate, the tester shall either void the run or shall plan to correct the sample volume as outlined in Section 6.3 of Method 5. Immediately after component changes, leak-checks are optional. If these leak-checks are done, the procedure outlined in Section 4.1.4.1 of Method 5 (with appropriate modifications) shall be used.

PLANT ________________
LOCATION ________________
OPERATOR ________________
DATE ________________
RUN NO. ________________
SAMPLE BOX NO. ________________
METER BOX NO. ________________
METER ΔHg ________________
C FACTOR ________________
PITOT TUBE COEFFICIENT, Cp ________________

SCHEMATIC OF STACK CROSS SECTION

STATIC PRESSURE, mm Hg (in. Hg) ________________
AMBIENT TEMPERATURE ________________
BAROMETRIC PRESSURE ________________
ASSUMED MOISTURE, % ________________
PROBE LENGTH, m (ft) ________________
NOZZLE IDENTIFICATION NO. ________________
AVERAGE CALIBRATED NOZZLE DIAMETER, cm (in.) ________________
PROBE HEATER SETTING ________________
LEAK RATE, m³/min, (cfm) ________________
PROBE LINER MATERIAL ________________
FILTER NO. ________________

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min.	VACUUM mm Hg (in. Hg)	STACK TEMPERATURE (Ts), °C (°F)	VELOCITY HEAD (ΔPs), mm H₂O (in. H₂O)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER, mm H₂O (in. H₂O)	GAS SAMPLE VOLUME, m³ (ft³)	GAS SAMPLE TEMPERATURE AT DRY GAS METER		TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER, °C (°F)
							INLET, °C (°F)	OUTLET, °C (°F)	
TOTAL							Avg	Avg	
AVERAGE							Avg		

Figure 8-2. Field data.

After turning off the pump and recording the final readings at the conclusion of each run, remove the probe from the stack. Conduct a post-test (mandatory) leak-check as in Section 4.1.4.3 of Method 5 (with appropriate modification) and record the leak rate. If the post-test leakage rate exceeds the specified acceptable rate, the tester shall either correct the sample volume, as outlined in Section 6.3 of Method 5, or shall void the run.

Drain the ice bath and, with the probe disconnected, purge the remaining part of the train, by drawing clean ambient air through the system for 15 minutes at the average flow rate used for sampling.

NOTE.—Clean ambient air can be provided by passing air through a charcoal filter. At the option of the tester, ambient air (without cleaning) may be used.

4.1.6 Calculation of Percent Isokinetic. Follow the procedure outlined in Method 5, Section 4.1.6.

4.2 Sample Recovery.

4.2.1 Container No. 1. If a moisture content analysis is to be done, weigh the first impinger plus contents to the nearest 0.5 g and record this weight.

Transfer the contents of the first impinger to a 250-ml graduated cylinder. Rinse the probe, first impinger, all connecting glassware before the filter, and the front half of the filter holder with 80 percent isopropanol. Add the rinse solution to the cylinder. Dilute to 250 ml with 80 percent isopropanol. Add the filter to the solution, mix, and transfer to the storage container. Protect the solution against evaporation. Mark the level of liquid on het container and identify the sample container.

4.2.2 Container No. 2. If a moisture content analysis is to be done, weigh the second and third impingers (plus contents) to the nearest 0.5 g and record these weights. Also, weigh the spent silica gel (or silica gel plus impinger) to the nearest 0.5 g.

Transfer the solutions from the second and third impingers to a 1000-ml graduated cylinder. Rinse all connecting glassware (including back half of filter holder) between the filter and silica gel impinger with deionized, distilled water, and add this rinse water to the cylinder. Dilute to a volume of 1000 ml with deionized, distilled water. Transfer the solution to a storage container. Mark the level of liquid on the container. Seal and identify the sample container.

4.3 Analysis.

Note the level of liquid in containers 1 and 2, and confirm whether or not any sample was lost during shipment; note this on the analytical data sheet. If a noticeable amount of leakage has occurred, either void the sample or use methods, subject to the approval of the Administrator, to correct the final results.

4.3.1 Container No. 1. Shake the container holding the isopropanol solution and the filter. If the filter breaks up, allow the fragments to settle for a few minutes before removing a sample. Pipette a 100-ml aliquot of this solution into a 250-ml Erlenmeyer flask, add 2 to 4 drops of thorin indicator, and titrate to a pink endpoint using 0.0100 N barium perchlorate. Repeat the titration with a second aliquot of sample and average the titration values. Replicate titrations must agree within 1 percent or 0.2 ml, whichever is greater.

4.3.2 Container No. 2. Thoroughly mix the solution in the container holding the contents of the second and third impingers. Pipette a 10-ml aliquot of sample into a 250-ml Erlenmeyer flask. Add ml of isopropanol, 2 to 4 drops of thorin indicator, and titrate to a pink endpoint using 0.0100 N barium perchlorate. Repeat the titration with a second aliquot of sample and average the titration values. Replicate titrations must agree within 1 percent or 0.2 ml, whichever is greater.

4.3.3 Blanks. Prepare blanks by adding 2 to 4 drops of thorin indicator to 100 ml of 80 percent isopropanol. Titrate the blanks in the same manner as the samples.

5. *Calibration*

5.1 Calibrate equipment using the procedures specified in the following sections of Method 5: Section 5.3 (metering system); Section 5.5 (temperature gauges); Section 5.7 (barometer). Note that the recommended leak-check of the metering system, described in Section 5.6 of Method 5, also applies to this method.

5.2 Standardize the barium perchlorate solution with 25 ml of standard sulfuric acid, to which 100 ml of 100 percent isopropanol has been added.

6. *Calculations*

NOTE.—Carry out calculations retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after final calculation.

6.1 Nomenclature.

A_n = Cross-sectional area of nozzle, m² (ft²).
B_{ws} = Water vapor in the gas stream, proportion by volume.
$C_{H_2SO_4}$ = Sulfuric acid (including SO_3) concentration, g/dscm (lb/dscf).
C_{SO_2} = Sulfur dioxide concentration, g/dscm (lb/dscf).
I = Percent of isokinetic sampling.
N = Normality of barium perchlorate titrant, g equivalents/liter.
P_{bar} = Barometric pressure at the sampling site, mm Hg (in. Hg).
P_s = Absolute stack gas pressure, mm Hg (in. Hg).
P_{std} = Standard absolute pressure, 760 mm Hg (29.92 in. Hg).
T_m = Average absolute dry gas meter temperature (see Figure 8-2), °K (°R).
T_s = Average absolute stack gas temperature (see Figure 8-2), °K (°R).
T_{std} = Standard absolute temperature, 293° K (528° R).
V_a = Volume of sample aliquot titrated, 100 ml for H_2SO_4 and 10 ml for SO_2.
V_{lc} = Total volume of liquid collected in impingers and silica gel, ml.
V_m = Volume of gas sample as measured by dry gas meter, dcm (dcf).
$V_{m(std)}$ = Volume of gas sample measured by the dry gas meter corrected to standard conditions, dscm (dscf).
v_s = Average stack gas velocity, calculated by Method 2, Equation 2-9, using data obtained from Method 5, m/sec (ft/sec).
V_{soln} = Total volume of solution in which the sulfuric acid or sulfur dioxide sample is contained, 250 ml or 1,000 ml, respectively.
V_t = Volume of barium perchlorate titrant used for the sample, ml.
V_{tb} = Volume of barium perchlorate titrant used for the blank, ml.
Y = Dry gas meter calibration factor.
ΔH = Average pressure drop across orifice meter, mm (in.) H_2O.
θ = Total sampling time, min.
13.6 = Specific gravity of mercury.
60 = sec/min.
100 = Conversion to percent.

6.2 Average dry gas meter temperature and average orifice pressure drop. See data sheet (Figure 8-2).

6.3 Dry Gas Volume. Correct the sample volume measured by the dry gas meter to standard conditions (20° C and 760 mm Hg or 68° F and 29.92 in. Hg) by using Equation 8-1.

$$V_{m(std)}=V_m Y\left(\frac{T_{std}}{T_m}\right)\frac{P_{bar}+\left(\frac{\Delta H}{13.6}\right)}{P_{std}}$$

$$=K_1 V_m Y\frac{P_{bar}+(\Delta H/13.6)}{T_m}$$

Equation 8-1

where:
K_1 = 0.3858 °K/mm Hg for metric units.
= 17.64 °R/in. Hg for English units.

NOTE.—If the leak rate observed during any mandatory leak-checks exceeds the specified acceptable rate, the tester shall either correct the value of V_m in Equation 8-1 (as described in Section 6.3 of Method 5), or shall invalidate the test run.

6.4 Volume of Water Vapor and Moisture Content. Calculate the volume of water vapor using Equation 5-2 of Method 5; the weight of water collected in the impingers and silica gel can be directly converted to milliliters (the specific gravity of water is 1 g/ml). Calculate the moisture content of the stack gas, using Equation 5-3 of Method 5. The "Note" in Section 6.5 of Method 5 also applies to this method. Note that if the effluent gas stream can be considered dry, the volume of water vapor and moisture content need not be calculated.

6.5 Sulfuric acid mist (including SO_3) concentration.

$$C_{H_2SO_4}=K_2\frac{N(V_t-V_{tb})\left(\frac{V_{soln}}{V_a}\right)}{V_{m(std)}}$$

Equation 8-2

where:
K_2 = 0.04904 g/milliequivalent for metric units.
= 1.081×10^{-4} lb/meq for English units.

6.6 Sulfur dioxide concentration.

$$C_{SO_2}=K_3\frac{N(V_t-V_{tb})\left(\frac{V_{soln}}{V_a}\right)}{V_{m(std)}}$$

Equation 8-3

where:
K_3 = 0.03203 g/meq for metric units.
= 7.061×10^{-5} lb/meq for English units.

6.7 Isokinetic Variation.

6.7.1 Calculation from raw data.

$$I=\frac{100\,T_s[K_4V_{lc}+(V_m/T_m)\,P_{bar}+\Delta H/13.6)]}{60\,\theta V_s P_s A_n}$$

Equation 8-4

where:
K_4 = 0.003464 mm Hg-m³/ml-°K for metric units.
= 0.002676 in. Hg-ft³/ml-°R for English units.

6.7.2 Calculation from intermediate values.

$$I=\frac{T_sV_{m(std)}P_{std}\,100}{T_{std}v_s\theta A_nP_s\,60\,(1-B_{ws})}$$

$$=K_5\frac{T_sV_{m(std)}}{P_sv_sA_n\theta(1-B_{ws})}$$

Equation 8-5

where:
K_5 = 4.320 for metric units.
= 0.09450 for English units.

6.8 Acceptable Results. If 90 percent ≤ I ≤ 110 percent, the results are acceptable. If the results are low in comparison to the standards and I is beyond the acceptable range, the Administrator may opt to accept the results. Use Citation 4 in the Bibliography of Method 5 to make judgments. Otherwise, reject the results and repeat the test.

7. *Bibliography*

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7. Annual Book of ASTM Standards. Part 31; Water, Atmospheric Analysis. pp. 40-42. American Society for Testing and Materials. Philadelphia, Pa. 1974.

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(Secs. 111, 114, 301(a), Clean Air Act, sec. 4(a) of Pub. L. 91-604, 84 Stat. 1683; sec. 4(a) of Pub. L. 91-604, 84 Stat. 1687; sec. 2 of Pub. L. 90-148, 81 Stat. 504 [42 U.S.C. 1857c-6, 1857c-9, 1857g(a)].)

[FR Doc.77-18008 Filed 8-17-77;8:45 am]

70

Title 40—Protection of Environment

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

[FRL 784-7]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

PART 61—NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS

Delegation of Authority; New Source Review; State of Montana

AGENCY: Environmental Protection Agency.

ACTION: Final rule.

SUMMARY: This rule will change the address to which reports and applications must be sent by operators of new sources in the State of Montana. The address change is the result of delegation of authority to the State of Montana for New Source Performance Standards (40 CFR Part 60) and National Emissions Standards for Hazardous Air Pollutants (40 CFR Part 61).

ADDRESS: Any questions or comments should be sent to Director, Enforcement Division, Environmental Protection Agency, 1860 Lincoln Street, Denver, Colo. 80295.

FOR FURTHER INFORMATION CONTACT:

Mr. Irwin L. Dickstein, 303-837-3886.

SUPPLEMENTARY INFORMATION: The amendments below institute certain address changes for reports and applications required from operators of new sources. EPA has delegated to the State of Montana authority to review new and modified sources. The delegated authority includes the review under 40 CFR Part 60 for the standards of performance for new stationary sources and review under 40 CFR Part 61 for national emission standards for hazardous air pollutants.

A Notice announcing the delegation of authority [illegible] the Federal Register [illegible]. The amendments provide that all reports, requests, applications, submittals, and communications previously required for the delegated reviews will now be sent to the Montana Department of Health and Environmental Sciences instead of EPA's Region VIII.

The Regional Administrator finds good cause for foregoing prior public notice and for making this rulemaking effective immediately in that it is an administrative change and not one of substantive content. No additional substantive burdens are imposed on the parties affected. The delegation which is reflected by this administrative amendment was effective on May 18, 1977, and it serves no purpose to delay the technical change of this addition of the State address to the Code of Federal Regulations.

This rulemaking is effective immediately, and is issued under the authority of sections 111 and 112 of the Clean Air Act, as amended, 42 U.S.C. 1857, 1857c-5, 6, 7 and 1857g.

Dated: August 17, 1977.

JOHN A. GREEN,
Regional Administrator.

Part 60 of Chapter I, Title 40 of the Code of Federal Regulations is amended as follows:

1. In § 60.4 paragraph (b) is amended by revising subparagraph (BB) to read as follows:

§ 60.4 Address.

* * * * *

(b) * * *

(BB) State of Montana, Department of Health and Environmental Services, Cogswell Building, Helena, Mont. 59601.

* * * * *

Part 61 of Chapter I, Title 40 of the Code of Federal Regulations is amended as follows:

2. In § 61.04 paragraph (b) is amended by revising subparagraph (BB) to read as follows:

§ 61.04 Address.

* * * * *

(b) * * *

(BB) State of Montana, Department of Health and Environmental Sciences, Cogswell Building, Helena, Mont. 59601.

[FR Doc.77-26027 Filed 9-2-77;8:45 am]

FEDERAL REGISTER, VOL. 42, NO. 172

TUESDAY, SEPTEMBER 6, 1977

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Title 40—Protection of Environment

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

SUBCHAPTER C—AIR PROGRAMS

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Applicability Dates; Correction

AGENCY: Environmental Protection Agency.

ACTION: Correction.

SUMMARY: This document corrects the final rule that appeared at page 37935 in the FEDERAL REGISTER of Monday, July 25, 1977 (FR Doc. 77-21230).

EFFECTIVE DATE: September 7, 1977.

FOR FURTHER INFORMATION CONTACT:

Don R. Goodwin, Emission Standards and Engineering Division, Environmental Protection Agency, Research Triangle Park, N.C. 27711, telephone No. 919-541-5271.

Dated: August 31, 1977.

EDWARD F. TUERK,
Acting Assistant Administrator,
for Air and Waste Management.

In FR Doc. 77-21230 appearing at page 37935 in the FEDERAL REGISTER of Monday, July 25, 1977, the following corrections are made to §§ 60.250(b) and 60.270(b) on page 37938:

1. The applicability date in § 60.250(b) is corrected to October 24, 1974.
2. The applicability date in § 60.270(b) is corrected to October 21, 1974.

(Sec. 111, 301(a) of the Clean Air Act as amended (42 U.S.C. 1857c-6, 1857g(a)).)

[FR Doc.77-26028 Filed 9-6-77;8:45 am]

FEDERAL REGISTER, VOL. 42, NO. 173

WEDNESDAY, SEPTEMBER 7, 1977

Title 40—Protection of Environment

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

[FRL 790-4]

PART 60—STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Delegation of Authority to State of Wyoming

AGENCY: Environmental Protection Agency.

ACTION: Final rule.

SUMMARY: This rule will change the address to which reports and applications must be sent by owners and operators of new and modified sources in the State of Wyoming. The address change is the result of delegation of authority to the State of Wyoming for New Source Performance Standards (40 CFR Part 60).

ADDRESS: Any questions or comments should be sent to Director, Enforcement Division, Environmental Protection Agency, 1860 Lincoln Street, Denver, Colo. 80295.

FOR FURTHER INFORMATION CONTACT:

Mr. Irwin L. Dickstein, 303–837–3868.

SUPPLEMENTARY INFORMATION: The amendments below institute certain address changes for reports and applications required from operators of new and modified sources. EPA has delegated to the State of Wyoming authority to review new and modified sources. The delegated authority includes the review under 40 CFR Part 60 for the standards of performance for new stationary sources.

A notice announcing the delegation of authority is published today in the FEDERAL REGISTER (Notices Section). The amendments now provide that all reports, requests, applications, submittals, and communications previously required for the delegated reviews will now be sent to the Air Quality Division of the Wyoming Department of Environmental Quality instead of EPA's Region VIII.

The Regional Administrator finds good cause for foregoing prior public notice and for making this rulemaking effective immediately in that it is an administrative change and not one of substantive content. No additional substantive burdens are imposed on the parties affected. The delegation which is reflected by this administrative amendment was effective on August 2, 1977, and it serves no purpose to delay the technical change of this addition of the State address to the Code of Federal Regulations.

(Sec. 111, Clean Air Act, as amended (42 U.S.C. 1857, 1857c–5, 6, 7, 1857g).

Dated: August 25, 1977.

JOHN A. GREEN,
Regional Administrator.

Part 60 of Chapter I, Title 40 of the Code of Federal Regulations is amended as follows:

1. In § 60.4 paragraph (b) is amended by revising subparagraph (ZZ) to read as follows:

§ 60.4 Address.

* * * * *

(b) * * *

(ZZ) State of Wyoming, Air Quality Division of the Department of Environmental Quality, Hathaway Building, Cheyenne, Wyo. 82002.

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[FR Doc.77-26905 Filed 9-14-77;8:45 am]

FEDERAL REGISTER, VOL. 42, NO. 179

THURSDAY, SEPTEMBER 15, 1977

SECTION V

STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Proposed Amendments

ENVIRONMENTAL PROTECTION AGENCY

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STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Proposed Emission Guidelines for the Control of Sulfuric Acid Mist From Existing Sulfuric Acid Production Units

SUBPART C

ENVIRONMENTAL PROTECTION AGENCY

[40 CFR Part 60]

[FRL 631-4]

STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Emission Guidelines for the Control of Sulfuric Acid Mist From Existing Sulfuric Acid Production Units

The purpose of this notice is to propose emission guidelines and times for compliance for the control of sulfuric acid mist emissions from existing sulfuric acid production units, and to announce the publication of a draft guideline document concerning the control of sulfuric acid mist emissions from such units.

The Clean Air Act (42 U.S.C. 1857 et seq.) as amended, applies to three general categories of pollutants emitted from stationary sources. The first category consists of pollutants (often referred to as "criteria pollutants") for which air quality criteria and national ambient air quality standards are established under sections 108 and 109 of the Act and which are controlled by state implementation plans under section 110. The second category consists of pollutants listed and controlled as hazardous pollutants under section 112 of the Act. The third category consists of pollutants that may cause or contribute to the endangerment of public health or welfare but are not or cannot be controlled under sections 108–110 or 112. Section 111(d) requires control of existing sources of such pollutants whenever standards of performance (for those pollutants) are established under section 111(b) for new sources of the same type. For convenience of reference, such pollutants are referred to as "designated pollutants," and existing facilities whose emissions of such pollutants must be controlled under section 111(d) are referred to as "designated facilities."

On November 17, 1975 (40 FR 53340), EPA promulgated a new subpart B to 40 CFR Part 60 establishing procedures and requirements for submittal of state plans for control of designated pollutants from designated facilities under section 111(d). A summary of subpart B and a discussion of the basic concepts underlying it appear in the preamble published in connection with its promulgation. In brief, subpart B provides that after a standard of performance applicable to emissions of a designated pollutant from new sources is promulgated, the Administrator will publish a draft guideline document containing information pertinent to the control of the same pollutant from designated (i.e., existing) facilities. He will also publish a notice of availability of the draft guideline document and invite comments on its contents. After publication of a final guideline document for the pollutant in question, the States will have nine months to develop and submit plans for control of that pollutant from designated facilities. Within four months after the date for submission of plans, the Administrator will approve or disapprove each plan (or portions thereof). If a state plan (or portion thereof) is disapproved, the Administrator will promulgate a plan (or portion thereof) within six months after the date for plan submission. These and related provisions of subpart B are basically patterned after section 110 of the Act and 40 CFR Part 51 (concerning adoption and submittal of state implementation plans under section 110).

As discussed in the preamble to subpart B, a distinction is drawn between designated pollutants which may cause or contribute to endangerment of public health (referred to as "health-related pollutants") and those for which adverse effects on public health have not been demonstrated (referred to as "welfare-related pollutants"). For health-related pollutants, emission standards and compliance schedules in state plans must ordinarily be at least as stringent as the corresponding emission guidelines and compliance times specified in EPA's guideline documents and codified in subpart C of 40 CFR Part 60. States may apply less stringent requirements when economic factors or physical limitations make such application significantly more reasonable. For welfare-related pollutants, States may balance the emission guidelines, compliance times, and other information in EPA's guideline documents against other factors of public concern in developing their plans, as explained more fully in the preamble to subpart B and in the introductory portion of each guideline document. Thus, the States have more flexibility in establishing plans for welfare-related pollutants than for plans involving pollutants that may affect public health.

Standards of performance for sulfuric acid mist emissions from new sulfuric acid production units were promulgated on December 23, 1971 (36 FR 24876). A draft guideline document for the control of sulfuric acid mist emissions from existing sulfuric acid production units has been prepared and is available as specified below. In accordance with section 117(f) of the Act, publication of the draft guideline document was preceded by consultation with appropriate advisory committees, independent experts, and Federal departments and agencies. A copy of the draft guideline document is available for inspection at the Public Information Reference Unit (EPA Library), Room 2922, 401 M Street, S.W., Washington, D.C. In addition, copies may be obtained free of charge by writing to the Public Information Center (PM-215), Environmental Protection Agency, Washington, D.C. 20460 (specify: Draft Guideline Document: Control of Acid Mist Emissions from Existing Sulfuric Acid Production Units, September 1976).

The Administrator has determined that sulfuric acid mist is a health-related pollutant. The rationale for this determination is included in Chapter 5 of the draft guideline document. In summary, sulfuric acid mist has been shown to cause acute and chronic irritation to the lungs and bronchial tubes in humans. Toxicological studies have shown that of all sulfates, sulfuric acid mist is the greatest respiratory irritant. There are human clinical studies specific to sulfuric acid mist which indicate health effects occur in healthy, young adults with short-term exposure to levels reasonably expected to occur around uncontrolled sulfuric acid plants. It is a reasonable conclusion that potentially more sensitive individuals such as infants, the elderly, and persons whose health is already compromised by pre-existing health problems would exhibit adverse effects at even lower levels than the clinical studies indicated, or more serious adverse effects at the levels studied.

In addition to health effects, sulfuric acid mist has the following effects on public welfare as that term is defined in the Act: reduced visibility; acceleration of metal corrosion; disintegration of building materials, especially those containing calcium carbonate; textile and paper damage; and vegetation damage.

The emission guideline and time for compliance in this proposed rulemaking reflect the Administrator's judgment on the degree of emission control achievable with the best system of emission reduction (considering the cost of such reduction) that has been adequately demonstrated for existing sulfuric acid production units and the time within which those systems can be purchased and installed. The proposed sulfuric acid mist emission guideline of 0.25 gram acid mist per kilogram of acid produced (0.5 lb/ton) is based upon the degree of control achievable through the application of fiber mist eliminators to existing sulfuric acid production units. There are three types of fiber mist eliminators: vertical tube, vertical panel, and horizontal dual pad. The vertical panel and horizontal dual pad mist eliminators are less effective and less expensive than the vertical tube mist eliminators. The acid mist standard of performance for new sulfuric acid plants (0.075 g/kg) was based on application of vertical tube mist eliminators. The reason for the difference between the emission guideline and the standard of performance for new sources is the consideration of cost. Sulfuric acid production units burning sulfur and producing only acid or low strength oleum are easily controlled to 0.25 g/kg using vertical panel or horizontal dual pad mist eliminators. Plants burning bound sulfur feedstocks and/or producing strong oleum normally must use vertical tube mist eliminators to attain 0.25 g/kg or less. Compliance with the new source standard requires installation of a vertical tube fiber mist eliminator on all types of plants. Many sulfur burning plants presently have horizontal dual pad or vertical panel type mist eliminators installed and thus, the double retrofitting involved with a guideline less than 0.25 g/kg would cause an adverse economic impact on the industry.

It is important to note that the economic analysis regarding double retrofitting leading to the emission guideline was performed on a national scale. State standards as low as the standard of performance for new sources can be supported as a best retrofit standard where double retrofitting is not an issue.

A complete discussion of the alternatives considered and other technical and economic factors which led to the guideline of 0.25 g/kg are included in the draft guideline document. The review of the economic impact has shown that the proposal is not a major action under the Inflationary Impact Statement (IIS) program and no IIS is needed.

Interested persons may participate in this rulemaking by submitting written comments (in triplicate) to the Emission Standards and Engineering Division, Environmental Protection Agency, Research Triangle Park, North Carolina 27711, Attention: Mr. Don R. Goodwin. The Administrator will welcome comments on all aspects of this proposal, including economic and technological issues and the determination that sulfuric acid mist is a health-related pollutant for purposes of section 111(d) and subpart B of 40 CFR Part 60. All relevant comments postmarked no later than December 6, 1976 will be considered. Copies of comments received will be available for inspection and copying during normal business hours at the Environmental Protection Agency, Public Information Reference Unit, Room 2922 (EPA Library), 401 M Street, S.W., Washington, D.C.

This notice of proposed rulemaking is issued under the authority of sections 111(d), 114, and 301(a) of the Clean Air Act, as amended (42 U.S.C. 1857c-6(d), 1857c-9, 1857g(a).)

Dated: October 28, 1976.

RUSSELL E. TRAIN,
Administrator.

It is proposed to amend Part 60 of Chapter I of Title 40 of the Code of Federal Regulations by adding subpart C as follows:

Subpart C—Emission Guidelines and Compliance Times

Sec.
60.30 Scope.
60.31 Definitions.
60.32 Designated facilities.
60.33 Emission guidelines.
60.34 Compliance times.

AUTHORITY: Secs. 111, 114, and 301(a) of the Clean Air Act, as amended by sec. 4(a) of Pub. L. 91-604, 84 Stat. 1678 and by sec. 15(c)(2) of Pub. L. 91-604, 84 Stat. 1713 (42 U.S.C. 1857c-6, 1857c-9 and 1857g(a)).

Subpart C—Emission Guidelines and Compliance Times

§ 60.30 Scope.

This subpart contains emission guidelines and compliance times for the control of certain designated pollutants from certain designated facilities in accordance with section 111(d) of the Act and Subpart B.

§ 60.31 Definitions.

Terms used but not defined in this subpart have the meaning given them in the Act and in Subparts A and B of this part.

§ 60.32 Designated facilities.

(a) *Sulfuric acid production units.* The designated facility to which §§ 60.33(a) and 60.34(a) apply is each existing "sulfuric acid production unit" as defined in § 60.81(a) of Subpart H.

§ 60.33 Emission guidelines.

(a) *Sulfdric acid production units.* The emission guideline for designated facilities is 0.25 gram sulfuric acid mist (as measured by Reference Method 8, of Appendix A) per kilogram of sulfuric acid produced (0.5 lb/ton), the production being expressed as 100 percent H_2SO_4.

§ 60.34 Compliance times.

(a) *Sulfuric acid production units.* Planning, awarding of contracts, and installation of equipment capable of attaining the level of the emission guideline established under § 60.33(a) can be accomplished within 17 months after the effective date of a State emission standard for sulfuric acid mist.

[FR Doc.76-32302 Filed 11-3-76;8:45 am]

ENVIRONMENTAL PROTECTION AGENCY

[40 CFR Part 60]

[FRL 631-4]

STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Emission Guidelines for the Control of Sulfuric Acid Mist From Existing Sulfuric Acid Production Units

Correction

In FR Doc. 76-32302, appearing at page 48706 in the issue for Thursday, November 4, 1976, the comment period in the second paragraph of the first column on page 48707 should be "January 3, 1977."

ENVIRONMENTAL PROTECTION AGENCY

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STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Lignite-Fired Steam Generators

SUBPART D

ENVIRONMENTAL PROTECTION AGENCY

[40 CFR Part 60]

[FRL 650-8]

STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Lignite-Fired Steam Generators

The Environmental Protection Agency (EPA) is considering amendments to Subpart D of 40 CFR Part 60 (Fossil Fuel-Fired Steam Generators) to establish standards of performance for emissions of nitrogen oxides from new lignite-fired steam generators of greater than 73 megawatts heat input (250 million Btu per hour) and to incorporate the International System of Units (modernized metric system), as applicable.

On December 23, 1971 (36 FR 24877), EPA promulgated standards of performance for fossil fuel-fired steam generators. Included were standards for particulate matter, sulfur divide, and nitrogen oxides applicable to gaseous, liquid, and solid fossil fuel-fired facilities. However, because of a lack of information on nitrogen oxides emissions, lignite-fired facilities were exempted from the nitrogen oxides standard for solid fossil fuels, although they are subject to the standards for particulate matter and sulfur dioxide.

EPA has gathered additional information on lignite-fired facilities and the background materials on the proposed amendment to Subpart D have been published in a report entitled "Standards Support and Environmental Impact Statement, Volume 1: Proposed Standards of Performance for Lignite-Fired Steam Generators", hereafter referred to as SSEIS. Copies are available on request from the EPA Public Information Center (PM-215), Environmental Protection Agency, Washington, D.C. 20460 (specify: Standards Support and Environmental Impact Statement, Volume 1: Proposed Standards of Performance for Lignite-Fired Steam Generators). The information contained in the SSEIS is briefly discussed in this preamble to the proposed standard of performance.

International System of Units

In accordance with the objective to implement national use of the metric system, EPA presents numerical values in both metric units and English units in its regulations and technical publications. In an effort to simplify use of the metric units of measurement, EPA now uses the International System of Units (SI) as set forth in a publication by the American Society for Testing and Materials entitled "Standard for Metric Practice" (Designation: E 380-76). Therefore, EPA is proposing to revise the appropriate sections of Subpart D to reflect use of SI units.

Proposed Standard

The proposed standard of performance limits emissions of nitrogen oxides to 260 nanograms per joule of heat input (0.6 pound per million Btu) from lignite-fired steam generators having a capacity greater than 73 megawatts heat input rate (250 million Btu per hour). The proposed standard reflects the degree of emission limitation achievable through the application of the best system of emission reduction which (taking into account the cost of achieving such reduction) has been adequately demonstrated. The best system is considered to be a combination of staged combustion and low excess air.

Economic and Environmental Impacts

Based on historical growth rates, it is estimated that 25 new lignite-fired steam generators would be subject to the proposed standard by 1985. The proposed standard would reduce NO_x emissions by 128,000 Mg/yr (141,000 T/yr). Controlling NO_x emissions to the level of the proposed standard would result in insignificant increases in capital and annualized costs for the utility.

Since approximately 90 percent of lignite-fired steam generators of rated capacity greater than 73 MW heat input are owned by electric utilities, the cost of complying with the proposed standard was analyzed for the lignite utility industry. The cost to the utilities appears to be negligible relative to the capital investment costs. Available information indicates that, at most, nitrogen oxides control would increase capital investment costs by only 0.5 percent for a new lignite-fired utility boiler and ancillary equipment. This cost increase for NO_x control represents an estimated increase of two dollars per installed kilowatt relative to an estimated typical cost of about 400 dollars per installed kilowatt capacity based on costs for a bituminous coal-fired boiler island. The costs for NO_x control would have negligible effect on power costs to consumers. The review of the economic impact has shown that the proposal is not a major action under the Inflationary Impact Statement (IIS) program, and no IIS is needed.

The environmental impact of the proposed standard is beneficial since the increase in emissions due to growth of lignite-fired steam generators would be minimized. The proposed standard should result in a 20 percent reduction in the mass of nitrogen oxide emissions from new lignite-fired boilers. It would reduce the atmospheric burden of nitrogen oxides and would help prevent increased ambient oxidant concentrations in areas where lignite-fired steam generators will be located (primarily North Dakota and Texas). There are no adverse environmental impacts associated with the proposed standard. Control techniques required to comply with the proposed standard do not cause boiler efficiency losses, and thus there are no incremental energy demands associated with the proposed standard. A complete analysis of the economic and environmental impacts may be found in Chapters VI and VIII of the SSEIS.

Control Systems

Nitrogen oxides from fossil-fuel combustion are formed via two mechanisms: (1) Thermal fixation (oxidation) of atmospheric nitrogen (N_2) in the combustion air, and (2) oxidation of organic nitrogen in the fuel. Oxidation of N_2 can be prevented by reducing the level of thermal excitation in the flame by means of (a) flue gas recirculation, (b) staged combustion, (c) water injection, (d) reduced air preheat, or (e) combinations of these techniques. Nitrogen oxides emissions due to the oxidation of organic nitrogen in the fuel can be controlled by using fuels with small amounts of organic nitrogen and by removing oxygen from the volatilization zone by means of (a) low excess air, (b) staged combustion, and/or (c) fuel/air mixing pattern adjustment (burner design). Fuels such as coal, residual oil, and lignite contain 0.2 to 1.5 percent organic nitrogen, and oxidation of this fuel-nitrogen may be responsible for as much as 80-90 percent of the total nitrogen oxides emissions from pulverized coal combustion. Therefore, the organic nitrogen content of fuel may be a limiting factor in controlling nitrogen oxides emissions. The fact that the organic nitrogen content of the U.S. lignites does not vary appreciably precludes nitrogen oxides control by switching to lignite with a lower organic nitrogen content.

Water injection and reduced air preheat significantly reduce the efficiency of a steam generator, and consequently are not practical nitrogen oxides control methods. Flue gas recirculation does not reduce nitrogen oxides emissions caused by the oxidation of the organic nitrogen in the lignite and it adversely affects the efficiency of a steam generator. Therefore, low excess air (LEA), staged combustion (SC), low emission burners, and combined LEA and SC are considered the most feasible control systems.

In addition to the control systems just discussed, the fuel burning equipment design parameters can affect the amount of nitrogen oxides emitted and the degree to which the control systems are effective. Lignite-firing has been demonstrated in pulverized-fired, cyclone-fired, and stoker-fired steam generating units. Stoker-fired units have the lowest heat release rate and thus have lower nitrogen oxides emissions than the other type units but are limited in physical size and are not expected to be of importance in future lignite-fired steam generating units. Cyclone-fired units have the highest heat release rate and the highest nitrogen oxides emissions. Pulverized-fired units have a lower heat release rate than cyclone-fired units, but a higher release rate than stoker-fired units.

EPA Test Program

Of the 15 lignite-fired units in domestic operation in 1974, four utility sized units were chosen for EPA's test program. Included were three pulverized-fired units (two tangentially-fired and one horizontally opposed-fired), and one cyclone-fired unit.

Operating with low excess air and/or staged combustion, all types of fuel burning equipment exhibited reduced nitrogen oxides emissions over baseline conditions. The horizontally opposed- and cyclone-fired units are more responsive to nitrogen oxides control techniques on a percentage basis, but the tangentially-fired units using staged combustion yielded the lowest nitrogen oxides emissions. Cyclone-fired units cannot be dependably operated with low excess air firing or staged combustion because of flame instability problems; however, staged combustion of cyclone-fired units can be achieved by firing auxiliary fuel.

On the basis of the test data, it appears that the cyclone-fired units cannot consistently meet a nitrogen oxides standard more stringent than 340 nanograms per joule (0.8 pound per million Btu). The test data also indicate that horizontally opposed-fired units would have difficulty consistently achieving a nitrogen oxides standard of 260 nanograms per joule (0.6 pound million Btu) over a long time period. However, development of low emission burners appears promising for application to horizontally opposed-fired units, and such units should be able to attain a standard of 260 nanograms per joule. Tangentially-fired units should have no difficulty meeting a standard of 260 nanograms per joule.

RATIONALE FOR PROPOSED STANDARDS

In deciding the nitrogen oxides limit for the proposed standard, EPA considered proposing the same standard for lignite-fired steam generators as the present standard for coal-fired steam generators, 300 nanograms per joule (0.7 pound per million Btu). In the study on control of nitrogen oxides emissions from lignite-fired steam generators, staged combustion and low excess air were found to reduce emissions significantly below 300 nanograms per joule input (0.7 pound per million Btu). The measured emission levels of 172 to 220 nanograms per joule heat input (0.4 to 0.5 pound per million Btu) indicated that the present standard for coal-fired units would not require use of best demonstrated control technology, considering costs, for lignite-fired units. Studies on control of nitrogen oxides emissions by combustion modification techniques have shown emission levels for modern bituminous and subbituminous coal-fired utility sized units to be similar to those observed for lignite-fired units. The lower emission levels observed for the lignite and bituminous fired units reflect an improvement in combustion modification techniques and in the design of the burners and of boilers between 1970 and 1974.

Tangentially-fired units could most likely meet a standard of 220 nanograms per joule (0.5 pound per million Btu). This standard, however may not be consistently achievable by the horizontally-opposed fired boilers. Since the manufacturers of these units do not make tangentially-fired boilers, a standard of 220 nanograms per joule could leave only one manufacturer of complying boilers, which would remove the option of power companies to obtain competitive bids. EPA requests comments on the following issues: (1) Whether horizontally-opposed fired boilers could meet a standard of 220 nanograms per joule; (2) if not, what would be the effect on the competitive balance of the equipment manufacturing industry; (3) what would be the effects on the power industry; and (4) whether EPA can consider these factors in setting standards based on the best system of emission reduction which has been adequately demonstrated.

The proposed standard of 260 nanograms per joule for lignite-fired steam generators is based on emission and cost data currently available to the Administrator. The proposed standard, while numerically more stringent than the present standard for coal-fired units, will require lignite-fired units to apply the same type of combustion modifications as coal-fired units. EPA recognizes that lignite-fired cyclone units cannot achieve the proposed standard of 260 nanograms per joule (0.6 pound per million Btu); therefore, EPA has considered the impact such a standard would have on boiler manufacturers and on the lignite-fired steam generating industry. EPA determined that the impact on boiler manufacturers of indirectly prohibiting cyclone-fired units would be negligible. Only one boiler manufacturer markets cyclone-fired units and that manufacturer also markets pulverized-fired units. Effective prohibition of cyclone-fired units is expected to have little effect on this manufacturer because these units represent a minor percentage of the total annual sales for the manufacturer.

The impact of the proposed standard on the lignite-fired steam generating industry is not well defined. EPA has attempted to determine whether units other than cyclone-fired units are available that will meet the proposed standard and if any cost or operating reliability advantages exist between these units and the cyclone-fired units. For large lignite-fired steam generators an alternative to cyclone-fired units is pulverized-fired units. From consultations with the major boiler manufacturers EPA concluded that cyclone-fired units do not have any significant investment cost advantages over an equivalent pulverized-fired unit. Thus, the impact of the prohibition of cyclone-fired units is dependent on the relative operational advantages of cyclone-fired units over pulverized-fired units.

Almost all of the large lignite-fired units in North Dakota have experienced severe operational difficulties as a result of ash fouling of the boiler tube surfaces. Utility boilers firing Texas lignites have not experienced ash fouling problems to the same degree. Research conducted by the Energy Research and Development Administration (ERDA) in Grand Forks, North Dakota, has shown that the sodium content of the lignite is highly correlated with the degree of ash fouling. Lignite ash with three to five percent sodium is considered to have a moderate to high fouling potential, and a sodium content greater than five percent has a severe fouling potential. In EPA's judgment, the ash fouling problem can be minimised by designing the boiler with more soot blowers in the convective passes than normal, with larger spacing between boiler tubes, and with design of the furnace temperature profile to control tube metal temperatures.

Some of the lignite utilities have claimed that cyclone-fired units can burn lignites with the higher sodium content more reliably than pulverized-fired units because a smaller proportion of the ash enters the boiler. The utilities cited the Minnkota Power Cooperative's cyclone-fired unit at Young-Center station as a successful example. This cyclone-fired, 235 MW boiler was selected and designed based on a cooperative study to develop a better method for firing high sodium lignite. The unit has an excellent record of operating availability since its startup in 1970. However, the unit has not fired the high sodium lignites for which it was designed. In addition, the operating reliability of this unit may be attributed to furnace design features other than the cyclone burner. Since startup of the Minnkota cyclone-fired unit, two additional cyclone-fired units have been placed in commercial operation by power companies and cooperatives in the area. Each of these units has been in operation for less than a year. Both units have been firing lignites of approximately 4 to 6 percent sodium and have been experiencing problems with ash fouling of the boiler tubes and with furnace slagging to different degrees. Since numerous operating problems typically occur in the first year of operation of a steam generator, more operating experience is needed before the performance and reliability of these units on high sodium lignite is evaluated.

Experience with pulverized-fired units is presently limited to two units designed in the early 1960's. At that time problems with plugging in the convective passages because of ash fouling associated with firing high sodium lignite were not fully appreciated. Consequently, these two units were retrofitted with an increased number of sootblowers and the tube spacings were increased in order to obtain reliable operation of the units. Redesign of this nature was implemented to different degrees on the units. The more extensively retrofitted unit has operated reliably for six years on lignite with four to six percent sodium in the ash and on eight to nine percent sodium lignite for the past year. The less extensively retrofitted unit can be reliably operated by maintaining the sodium content of the fuel below five percent. Based on this experience, new cyclone or pulverized lignite-fired units are designed with greater furnace surface area, increased superheater tube spacing, and increased number of sootblowers. This early experience with pulverized firing apparently has not convinced the utilities that pulverised firing of high sodium lignite is impractical. In the early 1970's, the United Power Association (UPA) purchased two pulverised-fired units, after evaluating bids on both cyclone and pulverised-fired units. These tangentially-fired 500 MW boilers were guaranteed to reliably fire a lignite with a design range of 0.1 to 4.8 percent sodium.

This selection of a pulverized-fired unit for a North Dakota lignite with high fouling potential indicates that pulverized-fired units are price competitive with cyclone-fired units and that at least one utility believes that cyclone-fired units are not required for use of a lignite with high fouling potential.

In addition to this limited experience with firing high sodium lignite, preliminary results from a study conducted by ERDA showed that cyclone-fired units have a statistically significant lower ash deposition rate than pulverized-fired units. The test was conducted while the units were firing 3.5 to 4.5 percent sodium lignite and insufficient information is available to allow comparison at higher sodium levels. One possible interpretation of these data is that cyclone-fired units can operate on high sodium lignite (greater than six percent) more reliably than pulverized-fired units. However, the study's results are not consistent with the experience of operating commercial units and the data may not warrant drawing this conclusion.

EPA has concluded from evaluation of the available information that (1) while there are differences in operational characteristics of pulverized and cyclone-fired units, both types can reliably operate on high sodium lignite and (2) cyclone-fired units do not have significant operation maintenance, or cost advantages over pulverized-fired units. The manufacturers of pulverized-fired units believe that these units can be as effective as cyclone-fired units for burning lignites, including those with high sodium. Combustion Engineering, which is installing the units for UPA, is confident that pulverized-fired units can be properly designed to handle the ash fouling and slagging problems of high sodium lignite. Babcock and Wilcox, the other major supplier of lignite-fired units, also believes that a pulverized-fired unit can be designed to reliably burn high sodium lignite. Due to the limited information available at this time and different possible interpretations of the information, EPA realizes that the assessment of relative reliability of pulverized and cyclone-fired units for firing high sodium lignite is debatable. Therefore, EPA is requesting that all interested persons submit factual information on this issue during the comment period. Factual information is specifically requested on the following areas of interest:

1. Investment costs and operation and maintenance costs for either pulverized-fired or cyclone-fired large steam generators designed for moderate or high sodium lignite.

2. The differences, if any, in the design of the convection section or the gas temperature profile between cyclone and pulverized-fuel fired steam generators. The comparison should discuss any differences in the number, type or location of sootblowers installed, frequency of operation of soot blowers, comparison of tube spacings or depth of tube banks and other relevant factors.

3. Relative importance of factors considered in selecting a cyclone- or pulverized-fired unit.

It is expected that the above information will allow EPA an opportunity to assess the relative costs of cyclone and pulverized fuel fired lignite steam generators as well as to assess the need for cyclone-fired units for use of high sodium lignite. The final standard will reflect the conclusions drawn from evaluation of all available factual information. EPA will limit the scope of coverage of the final standard if the data submitted during the comment period justify such a change. The scope of coverage could be limited by applying the standard to lignites having a specified sodium content, by establishing a separate standard for cyclone-fired units, or exempting cyclone-fired units.

It should be noted that standards of performance for new sources established under section 111 of the Clean Air Act reflect emission limits achievable with the best adequately demonstrated systems of emission reduction considering the cost of such systems. State implementation plans (SIP's) approved or promulgated under section 110 of the Act, on the other hand, must provide for the attainment and maintenance of national ambient air quality standards (NAAQS) designed to protect public health and welfare. For that purpose SIP's must in some cases require greater emission reductions than those required by standards of performance for new sources. In addition, States are free under section 116 of the Act to establish more stringent emission limits than those established under section 111 or those necessary to attain or maintain the NAAQS under section 110. Thus, new and existing sources may in some cases be subject to limitations more stringent than EPA's standards of performance under section 111.

PUBLIC PARTICIPATION

In accordance with section 117(f) of the Act, publication of these proposed amendments to 40 CFR Part 60 was preceded by consultation with appropriate advisory committees, independent experts, and Federal departments and agencies. Interested persons may participate in this rulemaking by submitting written comments (in triplicate) to the Emission Standards and Engineering Division, Environmental Protection Agency (MD-13), Research Triangle Park, North Carolina 27711, Attention: Mr. Don R. Goodwin. All comments received not later than 60 days from (date of proposal) will be considered. Copies of comments received will be available for inspection and copying during normal business hours at the Public Information Reference Unit, Room 2922 (EPA Library), 401 M Street, SW., Washington, D.C.

(Secs. 111, 114 and 301(a) of the Clean Air Act, as amended by sec. 4(a) of Pub. L. 91-604, 84 Stat. 1678 and by sec. 15(c) (2) of Pub. L. 91-604, 84 Stat. 1713 (42 U.S.C. 1857c-6, 1857c-9, and 1857g(a)))

The Environmental Protection Agency has determined that this document does not contain a major proposal requiring preparation of an Inflation Impact Statement under Executive Order 11821 and OMB Circular A-107.

Dated: December 15, 1976.

RUSSELL E. TRAIN,
Administrator.

It is proposed to amend Part 60 of Chapter I, Title 40 of the Code of Federal Regulations by revising Subparts A and D as follows:

Subpart A—General Provisions

1. Section 60.2 is amended by substituting the International System of Units (SI) in paragraph (1) as follows:

§ 60.2 Definitions.

* * * * *

(1) "Standard conditions" means a temperature of 293 K (68°F) and a pressure of 101.3 kilopascals (29.92 in. Hg).

* * * * *

Subpart D—Standards of Performance for Fossil Fuel-Fired Steam Generators

2. Section 60.41 is amended by adding paragraph (f) as follows:

§ 60.41 Definitions.

* * * * *

(f) "Coal" means all solid fossil fuels classified as anthracite, bituminous, subbituminous, or lignite by A.S.T.M. Designation D 388-66.

3. Section 60.44 is amended by adding paragraph (a)(4) and by revising paragraph (b) as follows:

§ 60.44 Standard for nitrogen oxides.

(a) * * *

(4) 260 nanograms per joule heat input (0.60 pound per million Btu) derived from lignite.

(b) When different fossil fuels are burned simultaneously in any combination, the applicable standards (in ng/J) shall be determined by proration. Compliance shall be determined by using the following formula:

$$PS_{NO} = \frac{w(260)+x(86)+y(130)+z(300)}{w+x+y+z}$$

where:

PS_{NO_x} is the prorated standard for nitrogen oxides when burning different fuels simultaneously, in nanograms per joule heat input derived from all fossil fuels fired or from all fossil fuel and wood residue fired;

w is the percentage of total heat input derived from lignite;

x is the percentage of total heat input derived from gaseous fossil fuel;

y is the percentage of total heat input derived from liquid fossil fuel;

z is the percentage of total heat input derived from solid fossil fuel (except lignite or a solid fossil fuel containing 25 pct, by weight, or more of coal refuse).

When a solid fossil fuel containing 25 percent, by weight, or more of coal refuse is burned in combination with gaseous, liquid or other solid fossil fuel, or wood residue, the standard for nitrogen oxides does not apply.

4. Section 60.45 is amended by adding paragraph (f)(4)(vi) as follows:

§ 60.45 Emission and fuel monitoring.

* * * * *

(f) * * *

(4) * * *

(vi) For lignite coal as classified according to A.S.T.M. D 388-66, $F = 2.659 \times 10^{-7}$ dscm/J (9900 dscf/million Btu) and $F_c = 0.516 \times 10^{-7}$ scm CO_2/J (1920 scf CO_2/million Btu).

[FR Doc 76-37484 Filed 12-21-76; 8:45 am]

ENVIRONMENTAL PROTECTION AGENCY

■

STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

PETROLEUM REFINERY

SUBPART J

ENVIRONMENTAL PROTECTION AGENCY

[40 CFR Part 60]

[FRL 610-7]

STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Petroleum Refinery Sulfur Recovery Plants

Notice is hereby given that under the authority of section 111 of the Clean Air Act, as amended, the Administrator is proposing standards of performance for new, modified or reconstructed petroleum refinery sulfur recovery plants.

The Administrator is also proposing a new reference method to be used for determining emissions of hydrogen sulfide and reduced sulfur compounds from petroleum refinery sulfur recovery plants.

PROPOSED STANDARDS

As proposed, the standards would apply to petroluem refinery sulfur recovery plants. Generally, these plants are physically located within petroleum refineries. Occasionally, however, refineries will pipe the sulfur-rich gas stream to a nearby facility, such as a chemical plant, where the sulfur is recovered. The standards would apply to all refinery sulfur recovery plants, whether they are physically located within a petroleum refinery, or within the confines of another facility.

The standards would limit the concentration of sufur dioxide (SO_2) in the gases discharged to the atmosphere to 0.025 percent by volume at zero percent oxygen and on a dry basis. Where the emission control system installed to comply with these standards discharges residual emissions of hydrogen sulfide (H_2S), carbonyl sulfide (COS), and carbon disulfide (CS_2), the standards would limit the concentration of H_2S and the total concentration of H_2S, COS and CS_2 (calculated as SO_2) in the gases discharged to the atmosphere, to 0.0010 percent and 0.030 percent by volume at zero percent oxygen and on a dry basis, respectively.

ENVIRONMENT AND ECONOMIC IMPACTS

The proposed standards would require new, modified or reconstructed refinery sulfur recovery plants to reduce emissions by about 99 percent compared to emissions from existing refinery sulfur recovery plants. This would increase the overall sulfur recovery of a typical refinery sulfur recovery plant from about 94 percent to about 99.9 percent.

It is expected that the proposed standards would apply to about 80 new refinery sulfur plants by 1980. Few, if any, modifications or reconstructions of existing refinery sulfur plants are anticipated. The proposed standards would reduce national sulfur dioxide emissions from these new refinery sulfur plants by about 55,000 tons per year.

This reduction in national SO_2 emissions would be obtained without adverse impacts on other aspects of the environment, such as increased solid waste disposal, water pollution, or noise. The proposed standards would also result in a reduction in the growth of national energy consumption by some 54 million kw-hr/yr, or about 90,000 barrels of fuel oil per year, by 1980.

The economic impact of the proposed standards would be reasonable both on large and on small refiners, although it is somewhat more severe on small refiners than large refiners. For the small refiner [processing less than 30,000 barrels per calendar day (BCD)], the proposed standards could reduce profitability, as measured by return on assets, by 1.5 to 7.5 percent. A price increase of only 0.25 to 1.0 percent on all petroleum products, however, would restore the small refiner's profitability. The impact on a large refiner (processing more than 30,000 BCD) is considerably less due to economies of scale. The proposed standards could reduce the profitability of a large refiner by 0.5 to 1.5 percent. A price increase of only 0.10 to 0.30 percent on all petroleum products, however, would restore the large refiner's profitability. Consequently, the proposed standards would not adversely affect the growth of either the large refinery or the small refiner sector of the domestic refining industry.

To comply with these proposed standards, the investment required by the domestic refining industry would total some $110 million (MM) over the five-year period from 1976 to 1980; the annual operating costs of the industry would increase by some $16 MM per year by 1980 and petroleum product prices could increase by 0.1 to 1.0 percent.

The review of the economic impact has shown that the proposal is not a major action under the Inflationary Impact Statement (IIS) program and no IIS is needed.

SELECTION OF SOURCE CATEGORY AND AFFECTED FACILITIES

Section 111 of the Clean Air Act directs the Administrator to establish standards of performance for new stationary sources of air pollution which may contribute significantly to air pollution which causes or contributes to the endangerment of public health or welfare. Sulfur recovery plants are a major source of SO_2 emissions in petroleum refineries. Although a few State or local regulations already require emission control equivalent to the proposed standards, most State regulations require less stringent control of refinery sulfur recovery plants.

Reducing SO_2 emissions from new, modified or reconstructed refinery sulfur recovery plants takes on importance in view of the expected growth in the numbers and sizes of these plants, and the urban location of many petroleum refineries where high ambient air concentrations of SO_2 already exist. Current growth projections for the domestic petroleum refining industry, for example, indicate that refinery sulfur recovery plant capacity will double between 1976 and 1980.

Considering these factors, the proposed standards have been developed to limit emissions of SO_2 from petroleum refinery sulfur recovery plants. Some of the emission control systems that might be installed to reduce emissions of SO_2, however, discharge residual emissions of hydrogen sulfide (H_2S), carbonyl sulfide (COS) and carbon disulfide (CS_2) to the atmosphere. The proposed standards, therefore, include limits on emissions of these pollutants.

RATIONALE

Two alternative systems of SO_2 emission control were considered as candiates to serve as the basis for standards of performance: (1) the low-temperature extended Claus reaction system (alternative I) and (2) various tail gas scrubbing systems (alternative II). The alternative I systems reduce emisssion from uncontrolled refinery sulfur recovery plants by 80–85 percent, while the alternative II systems reduce emissions by 98–99 percent. Overall sulfur recovery of the refinery sulfur plant is increased from 95 to 99.9 percent with the use of an alternative II system.

Standards of performance based on alternative I would have an essentially negligible impact on SO_2 emissions since most state implementation plans (SIP's) already require equivalent control. As outlined above, however, standards based on alternative II would reduce SO_2 emissions by about 90 percent below levels required by most SIP's and would lead to a reduction in national SO_2 emissions of some 55,000 tons per year in 1980. Standards based on alternative II would also have no adverse environmental impacts in other areas such as increased water pollution, solid waste disposal, energy consumption, or noise. In addition, the economic impact of standards based on alternative II would be reasonable both on large and on small refiners. Consequently, alternative II represents the best system of emission reduction and the proposed standards are based on this alternative.

The tail gas scrubbing systems of alternative II, however, include two different types of emission control systems for reducing SO_2 emissions from refinery sulfur recovery plants: oxidation control systems and reduction control systems. In the oxidation control system, the SO_2 emissions from a refinery sulfur plant are controlled directly by tail gas scrubbing. In the reduction control system, the SO_2 emissions are first converted to H_2S emissions which are then controlled by tail gas scrubbing. Residual emissions discharged into the atmosphere from oxidation control systems or from reduction control systems which are followed by incineration consist of SO_2. Residual emissions discharged from reduction control systems which are not followed by incineration, however, consist of H_2S, COS (carbonyl sulfide) and CS_2 (carbon disulfide). Standards limiting emissions of SO_2, therefore, while appropriate for oxidation control systems or reduction control systems followed by incineration, are not appropriate for reduction control systems not followed by incineration.

Where reduction control systems which are not followed by incineration are properly operated and maintained, emissions of reduced sulfur compounds (H_2S, COS and CS_2) are insignificant. With poor operation and maintenance, however, emissions of these pollutants from these systems could lead to significant odor problems, primarily from the H_2S emitted. This situation presents a difficulty in selecting which pollutants should be controlled under the proposed standards due to the provisions of section 111(d) of the Act. Sulfur dioxide is a criteria pollutant for which State control of existing sources is not required under section 111(d) (since such control is already required by section 110). Reduced sulfur compounds, on the other hand, would be considered designated pollutants subject to the provisions of section 111(d).

Under the EPA regulations implementing section 111(d), after promulgation of a standard of performance for the control of such a designated pollutant, EPA must develop a guideline document containing the necessary information for States to develop plans for controlling emissions of the pollutant (40 CFR 60.22). In this case the document would have to cover information pertinent to the control of reduced sulfur compounds from all existing petroleum refinery sulfur plants which have installed reduction control systems which are not followed by incineration. After final issuance of the guideline document by EPA, all States containing affected plants are required by 40 CFR 60.23 to develop such plans and submit them to EPA for approval. Currently, about 25 refinery sulfur plants in seven States have installed reduction control systems which are not followed by incineration. Developing the guideline document and State plans, therefore, could be a significant undertaking, requiring the expenditure of considerable resources at the Federal level and by seven States and their local governments. Thus, one purpose of this proposal is to solicit comments from the affected States as to the burden imposed by the implementation of section 111(d) in this case.

If that burden imposed by the implementation of section 111(d) is great, EPA will consider the course of declining to require the adoption and submittal of State plans under 40 CFR 60.24. This option is available due to the unusual factual situation: all existing refinery sulfur plant, which have installed reduction control systems which are not followed by incineration (25 plants in seven States) already have very low emissions of reduced sulfur compounds. Their emission control systems have been installed to comply with State or local air pollution control regulations limiting emissions of SO_2 from existing refinery sulfur plants. To ensure that the installation of these emission control systems do not lead to local odor problems, these regulations also limit emissions of reduced sulfur compounds either directly or indirectly. Where emissions of reduced sulfur compounds are limited directly, local regulations specify the maximum concentrations of H_2S and reduced sulfur compounds (H_2S, COS and CS_2) that can be present in the tail gases discharged to the atmosphere. Where this approach has been followed, emissions of H_2S are limted to 10 ppm and emissions of reduced sulfur compounds are limited to either 300 or 500 ppm.

Where emissions of reduced sulfur compounds are limited indirectly by local regulations, these regulations require that the best available emission control technology be installed. In the process of specifying the best emission control technology, local air pollution control agencies have contacted EPA, vendors of various emission control system, and other local air pollution control agencies where these emission control systems have been installed. In terms of limiting emissions of reduced sulfur compounds, this approach has achieved the same end result as the direct regulatory approach. All 25 reduction control system which are now operating have been designed and guaranteed by the vendors of these systems to limit emissions to less than 10 ppm H_2S and less than 300 or 500 ppm reduced sulfur compounds.

Consequently, the current 25 petroleum refinery sulfur plants which have installed reduction control systems which are not followed by incineration are not considered by EPA to be significant sources of reduced sulfur compound emissions. Developing State plans under section 111(d) to control emissions of these pollutants from these facilities, therefore, would not reduce existing emission levels.

On the other hand, if EPA were to propose standards of performance for refinery sulfur plants only for SO_2 without limiting emissions of reduced sulfur compounds, this action could be interpreted to mean that EPA does not consider the potential air pollution problem posed by emissions of reduced sulfur compounds to be important. Such an interpretation could encourage new plants to be built without limiting emissions of these pollutants.

Having determined that the proposed regulation should cover emissions of reduced sulfur compounds from new refinery sulfur recovery plants, but not existing ones, EPA is left with the problem of selecting the appropriate pollutants to control with the proposed standards. Limiting emissions of SO_2 alone would be unsatisfactory due to the risk of reduced sulfur compound pollution from new plants. Limiting reduced sulfur compound emissions as well as SO_2 for new sources will cause some expenditure of effort on the part of EPA and the affected States which is not in fact necessary to achieve control of existing plants.

Considering all the facets of this situation, EPA proposes to limit emissions of both SO_2 and reduced sulfur compounds by these standards of performance, fulfilling the intent of section 111 of the Act to prevent new air pollution problems by requiring new, modified, or reconstructed plants to install the best systems of emission reduction considering costs. However, EPA is considering two alternative routes for treating the problem of existing sources. One alternative is for EPA to issue a guideline document under 40 CFR 60.22 (based primarily on the information available in the support documents for these standards of performance) and to require the seven affected States to submit plans under 40 CFR 60.23. Those States that already regulate reduced sulfur compounds by State law will be able to submit relatively simple control plans. Those States in which regulation of reduced sulfur compounds has been accomplished by local ordinances may have to provide for State enforcement before their control plans can be approved.

If the first alternative appears to be excessively burdensome, EPA is also considering a second alternative, because the 25 existing sources are well controlled. The purpose of limiting pollutant emissions from existing sources under the provisions of section 111(d) is to control a pollutant which may cause or contribute to the endangerment of public health or welfare, but is not known to be "hazardous" within the meaning of section 112, and is not controlled under sections 108 through 110. Since action under section 111(d) in this instance would not further control the pollutant in question, and existing refinery sulfur plants which have installed reduction control systems not followed by incineration are not endangering the public health or welfare, the conclusion can be drawn that there is no purpose to limiting emissions of these pollutants under section 111(d). Under this alternative, EPA would not issue a guideline document, the chain of events requiring States to develop plans for controlling emissions of these pollutants would not be initiated and these plans would not be developed. (A detailed discussion of this alternative may be found in the Standards Support and Environmental Impact Statement for Petroleum Sulfur Recovery Plants.)

The data and information available for selecting specific emission limits include the results of emission tests both by the Agency and by local air pollution control agencies, discussions with owners and operators which have installed and are now operating either the oxidation control systems or the reduction control systems, and discussions with the vendors of these emission control systems. The SO_2 emission limit is based on emission tests at a refinery sulfur plant controlled by an oxidation control system and at a refinery sulfur plant controlled by a reduction control system followed by incineration. The H_2S and reduced sulfur compound emission limits are based on emission source tests at three refinery sulfur plants controlled by reduction control systems not followed by incineration. The numerical values were selected including a reasonable margin for error taking into consideration the limited data base, the relative "newness" of the plants tested, pilot-plant data available from vendors on long-term operation, and the experience of owners and operators with these emission control systems.

The 0.025 percent by volume limit for SO_2 emissions and the 0.030 percent by volume limit for reduced sulfur compound emissions are also equivalent, in the sense that both require achieving the same degree of overall sulfur recovery (i.e., 99.9 percent). The numerical limit on SO_2 emissions is lower due to the somewhat greater volume of gases discharged from oxidation control systems and reduction control systems followed by incineration, which is inherent in their design and operation.

It should be noted that standards of performance for new sources established under section 111 of the Clean Air Act reflect emission limits achievable with the best adequately demonstrated system of emission reduction considering the cost of such systems. State implementation plans (SIP's) approved or promulgated under section 110 of the Act, on the other hand, must provide for the attainment and maintenance of national ambient air quality standards (NAAQS) designed to protect public health and welfare. For that purpose SIP's must in some cases require greater emission reductions than those required by standards of performance for new sources. Indeed, building of new sources may be precluded altogether in some geographical areas. In addition, States are free under section 116 of the Act to establish more stringent emission limits than those established under section 111 or those necessary to attain or maintain the NAAQ under section 110. Thus, new sources may in some cases be subject to limitations more stringent than EPA's standards of performance under section 111, and prospective owners and operators of new sources should be aware of this possibility in planning for such facilities.

ENERGY

The impact of the proposed standards on the energy consumption of a refinery sulfur recovery plant varies depending on the type of emission control system installed to comply with the standards. If an oxidation control system or a reduction control system followed with incineration were used, the overall energy consumption of a typical sulfur recovery plant would be increased by some 30 percent. If a reduction control system not followed by incineration were used, however, the overall energy consumption would be reduced by some 50 percent. These percentages are high primarily because refinery sulfur recovery plants consume little energy. Typically, for example, a refinery sulfur recovery plant accounts for less than 1 percent of the total energy consumed within a petroleum refinery.

Assuming half of the refinery sulfur recovery plants affected by the proposed standards by 1980 install oxidation control systems or reduction control systems followed by incineration and half install reduction control systems not followed by incineration, the proposed standards would reduce national energy consumption in 1980 by some 54 million kw-hr/yr, or about 90,000 barrels of fuel oil per year.

MONITORING, TESTING, AND RECORDKEEPING

As proposed, the regulations would require monitoring of emissions released to the atmosphere to insure that the emission control systems installed to comply with the proposed standards are properly maintained and operated. If an oxidation control system or a reduction control system followed by incineration were installed, monitoring of SO_2 emissions would be required and if a reduction control system not followed by incineration were installed, monitoring of H_2S and reduced sulfur compound emissions would be required.

Emission monitoring systems for SO_2 are readily available and performance specifications for these monitors have already been promulgated by EPA in 40 CFR Part 60 Appendix B. Although a few emission monitoring systems for H_2S and reduced sulfur compounds are available, EPA has not yet developed performance specifications for these monitors. Consequently, until EPA proposes and promulgates these performance specifications, owners and operators subject to the requirement to install H_2S and reduced sulfur compound emission monitors will not be required to do so. The requirement to install these monitors is included in the proposed regulations; however, to ensure that when EPA promulgates these performance specifications, those owners and operators who have installed reduction control systems not followed by incineration which are subject to the proposed standards will be required to retrofit these monitors. This will enable enforcement personnel to ensure that these emission control systems are being properly operated and maintained.

The reference method for determining compliance also depends on the emission control system employed to comply with the proposed standards. If an oxidation control system or a reduction control system followed by incineration were installed, Method 6—Determination of Sulfur Dioxide Emissions from Stationary Sources would be used to determine emissions of SO_2. If a reduction control system not followed by incineration were installed, the proposed Reference Method 15—Determination of Hydrogen Sulfide and Reduced Sulfur Compound Emissions from Sulfur Recovery Plants would be used to determine emissions of H_2S and total emissions of H_2S, COS, and CS_2 (calculated as SO_2).

The proposed Reference Method 15 is based on gas chromatographic separation followed by flame photometric detection. This method permits separation and identification of each individual pollutant (i.e., H_2S, COS and CS_2). To determine compliance with the proposed standards, a sample of the gases discharged to the atmosphere is analyzed to determine emissions of H_2S, COS and CS_2. The concentration of H_2S in these gases is determined directly. The concentration of reduced sulfur compounds in these gases is determined indirectly, by adding together the concentrations of H_2S, COS and CS_2. Since emissions are calculated as SO_2, however, the concentrations of CS_2 (having twice the sulfur per molecule of gas) is multiplied by two before adding it to the concentrations of H_2S and COS.

AMENDMENT OF SUBPART J OF PART 60

The proposed standards would be incorporated into 40 CFR Part 60 by amending Subpart J—Standards of Performance for Petroleum Refineries. Maintaining clarity within Subpart J while incorporating the proposed standards requires amendment of a number of existing paragraphs. In all but the case discussed below, these paragraphs have merely been rewritten with no change in content or intent.

Recently, it has been brought to the attention of the Administrator that as Subpart J is now written, a fluid catalytic cracking unit incinerator waste-heat boiler is an affected facility subject to the standard limiting emissions of particulate matter. Thus, if an owner or operator installs an incinerator waste-heat boiler, that boiler must comply with the standard on particulate emissions.

An incinerator waste-heat boiler, however, is an emission control device which reduces emissions of carbon monoxide from a fluid catalytic cracking unit catalyst regenerator. It was not EPA's intent that installation of an emission control device to reduce carbon monoxide emissions would then require installation of another emission control device to reduce particulate emissions. Rather, the intent was to consider the fluid catalytic cracking unit catalyst regenerator together with any associated incinerator waste-heat boiler in terms of controlling particulate emissions. If an incinerator waste-heat boiler which burns additional liquid or solid fossile fuel is in use, an increase in total particulate emissions would be permitted, consistent with good control of particulate emissions from the combustion of that increment of fuel. Accordingly, fluid catalytic cracking unit incinerator waste-heat boilers have been deleted from the list of affected facilities. This amendment of Subpart J, however, is not a change in the intent of the existing standard of performance limiting emissions of particulate matter.

PUBLIC PARTICIPATION

As prescribed by section 111 of the Clean Air Act as amended, this proposal of standards of performance has been preceded by the Administrator's determination that refinery sulfur recovery plants contribute significantly to air pollution which causes or contributes to the endangerment of public health or welfare. By publication of this determination in this issue of the FEDERAL REGISTER he adds petroleum refinery sulfur recovery plants to the list of affected facilities under the source category of petroleum refineries. In accordance with section 117 of the Act, publication of these proposed standards was preceded by consultation with appropriate advisory committees, independent experts, and Federal departments and agencies.

Interested persons may participate in this rulemaking by submitting written comments (in triplicate) to the Emission Standards and Engineering Division, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711, Attention: Mr. Don R. Goodwin. The Administrator will welcome comments on all aspects of the proposed regulations, including the designation of sulfur recovery plants as a significant contributor to air pollution which causes or contributes to the endangerment of public health or welfare, economic and technological issues, and the proposed test method.

Comments are invited specifically on the severity of the economic impact of the proposed standards on the small refiner, since a number of interested parties have expressed objection to the absence of a lower level cut-off exempting the small refiner from compliance with the standards. Any comments submitted to the Administrater on this issue, however, should contain specific information and data pertinent to an evaluation of the magnitude of this impact and its severity.

Also, the Administrator would be especially interested in receiving comments regarding the issue of controlling reduced sulfur compound emissions without implementing section 111(d), particularly as this would affect the seven States involved.

All relevant comments received on or before December 3, 1976 will be considered. Comments received will be available for public inspection and copying at the EPA Public Information Reference Unit, Room 2922 (EPA Library), 401 M Street, SW., Washington, D.C. 20460.

Background information on these proposed standards of performance has been published in a document "Standard Support and Environmental Impact Statement—Standards of Performance for Petroleum Refinery Sulfur Plants." This document presents the factors considered in the development of the proposed standards, including alternative emission control systems, emission test data, environmental impact, costs and economic considerations. Copies of the document are available free of charge by writing to the Public Information Center (PM-215), U.S. Environmental Protection Agency, Washington, D.C. 20460 (specify "Standards Support and Environmental Impact Statement—Standards of Performance for Petroleum Refinery Sulfur Plants").

Authority. This notice of proposed rulemaking is issued under the authority of sections 111, 114 and 301(a) of the Clean Air Act, as amended (42 U.S.C. 1857c–6 and 9).

Dated: September 16, 1976.

JOHN QUARLES,
Acting Administrator.

It is proposed to amend 40 CFR Part 60 as follows:

Subpart J—Standards of Performance for Petroleum Refineries

1. Section 60.100 is revised as follows:

§ 60.100 Applicability and designation of affected facility.

The provisions of this subpart are applicable to the following affected facilities in petroleum refineries: fluid catalytic cracking unit catalyst regenerators, fuel gas combustion devices, and sulfur recovery plants.

2. Section 60.101 is amended by adding paragraphs (i) through (l) as follows:

§ 60.101 Definitions.

* * * * *

(i) "Sulfur recovery plant" means a process unit which converts hydrogen sulfide produced within a petroleum refinery to elemental sulfur. The sulfur recovery plant need not be physically located within a petroleum refinery.

(j) "Oxidation control system" means an emission control system which reduces emissions from sulfur recovery plants by converting these emissions to sulfur dioxide.

(k) "Reduction control system" means an emission control system which reduces emissions from sulfur recovery plants by converting these emissions to sulfur dioxide.

(k) "Reduction control system" means an emission control system which reduces emissions from sulfur recovery plants by converting these emissions to hydrogen sulfide.

(l) "Reduced sulfur compounds" mean hydrogen sulfide (H_2S), carbonyl sulfide (COS) and carbon disulfide (CS_2).

3. Section 60.102 is amended by revising paragraph (a) introductory text and paragraph (b) as follows:

§ 60.102 Standard for particulate matter.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall discharge or cause the discharge into the atmosphere from any fluid catalytic cracking unit catalyst regenerator:

* * * * *

(b) Where the gases discharged by the fluid catalytic cracking unit catalyst regenerator pass through an incinerator or waste heat boiler in which auxiliary or supplemental liquid or solid fossil fuel is burned, particulate matter in excess of that permitted by paragraph (a)(1) of this section may be emited to the atmosphere, except that the incremental rate of particulate matter emissions shall not exceed 43.0 g/MJ (0.10 lb/million Btu) of heat input attributable to such liquid or solid fossil fuel.

4. Section 60.104 is amended by revising paragraph (a) as follows:

§ 60.104 Standard for sulfur dioxide.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall:

(1) Burn in any fuel gas combustion device any fuel gas which contains hydrogen sulfide in excess of 230 mg/dscm (0.10 gr/dscf), except that the gases resulting from the combustion of fuel gas may be treated to control sulfur dioxide emissions provided the owner or operator demonstrates to the satisfaction of the Administrator that this is as effective in preventing sulfur dioxide emissions to the atmosphere.

(2) Discharge or cause the discharge of any gases into the atmosphere from any sulfur recovery plant containing in excess of:

(i) 0.025 percent by volume of sulfur dioxide at zero percent oxygen on a dry basis if emissions are controlled by an oxidation control system, or a reduction control system followed by incineration, or

(ii) 0.030 percent by volume of reduced sulfur compounds and 0.0010 percent by volume of hydrogen sulfide calculated as sulfur dioxide at zero percent oxygen on a dry basis if emissions are controlled by a reduction control system not followed by incineration.

* * * * *

5. Section 60.105 is amended by adding paragraphs (a)(4) and (5) and (e)(3)(i) and (ii) as follows:

§ 60.105 Emission monitoring.

(a) * * *

(4) An instrument for continuously monitoring and recording concentrations of H_2S in fuel gases burned in any fuel gas combustion device, if compliance with § 60.104(a) is achieved by removing H_2S from the fuel gas before it is burned; or an instrument for continuously monitoring and recording concentrations of SO_2 in the gases discharged into the atmosphere from the combustion of any fuel gas, if compliance with § 60.104(a) is achieved by removing SO_2 from the combusted fuel gases. If the concentration of H_2S is monitored, fuel gas combustion devices having a common source of fuel gas may be monitored at one location, if monitoring at this location accurately represents the concentration of H_2S in the fuel gas burned.

(5) An instrument for continuously monitoring and recording concentrations of SO_2 in the gases discharged into the atmosphere from the sulfur recovery plant if compliance with § 60.104(b) is achieved through the use of an oxidation control system, or a reduction control system followed by incineration; or an instrument for continuously monitoring and recording concentrations of H_2S and reduced sulfur compounds in the gases discharged into the atmosphere from the sulfur recovery plant if compliance with § 60.104(b) is achieved through the use

of a reduction control system not followed by incineration.

* * * * *

(e) * * *

(1) [Reserved]

(2) [Reserved]

(3) Sulfur dioxide. (i) Any hourly period during which the average concentration of H_2S in fuel gas combusted in any fuel gas combustion device subject to § 60.104(a) exceeds 230 mg/dscm (0.10 gr/dscf), if compliance with § 60.104(a) is achieved by removing H_2S from the fuel gas before it is burned; or any hourly period during which the average concentration of SO_2 in the gases discharged into the atmosphere from any fuel gas combustion device subject to § 60.104(a) exceeds the level specified in § 60.104(a), if compliance with § 60.104(a) is achieved by removing SO_2 from the combusted fuel gases.

(ii) Any four-hour period during which the average concentration of SO_2 in the gases discharged into the atmosphere from any sulfur recovery plant subject to § 60.104(b) exceeds the level specified in § 60.104(b)(1) if compliance with § 60.104(b) is achieved through the use of an oxidation control system or a reduction control system followed by incineration; or any four-hour period during which the average concentration of H_2S, or reduced sulfur compounds in the gases discharged into the atmosphere from any sulfur plant subject to § 60.104(b) exceeds the levels specified in § 60.104(b)(2) if compliance with § 60.104(b) is achieved through the use of reduction control systems not followed by incineration.

6. Section 60.106 is amended by revising paragraphs (c) and (d) as follows:

§ 60.106 Test methods and procedures.

* * * * *

(c) For the purpose of determining compliance with § 60.104(a), Method 11 shall be used to determine the concentration of H_2S and Method 6 shall be used to determine the concentration of SO_2.

(1) If Method 11 is used, the gases sampled shall be introduced into the sampling train at approximately atmospheric pressure. Where refinery fuel gas lines are operating at pressures substantially above atmosphere, this may be accomplished with a flow control valve. If the line pressure is high enough to operate the sampling train without a vacuum pump, the pump may be eliminated from the sampling train. The sample shall be drawn from a point near the centroid of the fuel gas line. The minimum sampling time shall be 10 minutes and the minimum sampling volume 0.01 dscm (0.35 dscf) for each sample. The arithmetic average of two samples of equal sampling time shall constitute one run. Samples shall be taken at approximately 1-hour intervals. For most fuel gases, sample times exceeding 20 minutes may result in depletion of the collecting solution, although fuel gases containing low concentrations of hydrogen sulfide may necessitate sampling for longer periods of time.

(2) If Method 5 is used, Method 1 shall be used for velocity traverses and Method 2 for determining velocity and volumetric flow rate. The sampling site for determining SO_2 concentration by Method 6 shall be the same as for determining volumetric flow rate by Method 2. The sampling point in the duct for determining SO_2 concentration by Method 6 shall be at the centroid of the cross section if the cross sectional area is less than 5 m^2 (54 ft^2) or at a point no closer to the walls than 1 m (30 inches) if the cross sectional area is 5 m^2 or more and the centroid is more than one meter from the wall. The sample shall be extracted at a rate proportional to the gas velocity at the sampling point. The minimum sampling time shall be 10 minutes and the minimum sampling volume 0.01 dscm (0.36 dscf) for each sample. The arithmetic average of two samples of equal sampling time shall constitute one run. Samples shall be taken at approximately one-hour intervals.

(d) For the purpose of determining compliance with § 60.104(b), Method 6 shall be used to determine the concentration of SO_2 and Method 15 shall be used to determine the concentration of H_2S and reduced sulfur compounds.

(1) If Method 6 is used, the procedure outlined in paragraph (c)(2) of this section shall be followed except that each run shall span a minimum of four consecutive hours of continuous sampling. A number of separate samples may be taken for each run, provided the total sampling time of these samples adds up to a minimum of four consecutive hours. Where more than one sample is used, the average SO_2 concentration for the run shall be calculated as the time weighted average of the SO_2 concentration for each sample according to the formula:

$$C_R=\sum_{i=1}^{N} C_{S_i}\frac{t_{S_i}}{T}$$

Where:
C_R = SO_2 concentration for the run.
N = Number of samples.
C_{S_i} = SO_2 concentration for sample i.
t_{S_i} = Continuous sampling time of sample i.
T = Total continuous sampling time of all N samples.

(2) If Method 15 is used, each run shall consist of 16 samples taken over a minimum of four hours. The sampling point shall be at the centroid of the cross section of the duct if the cross sectional area is less than 5 m^2 (54 ft^2) or at a point no closer to the walls than 1 m (30 inches) if the cross sectional area is 5 m^2 or more and the centroid is more than 1 meter from the wall. To insure minimum residence time for the sample inside the sample lines, the sampling rate shall be at least 3 liters/minute (0.1 ft^3/min). The SO_2 equivalent for each run shall be calculated as the arithmetic average of the SO_2 equivalent of each sample during the run. Reference Method 4 shall be used to determine the moisture content of the gases. The sampling point for Method 4 shall be adjacent to the sampling point for Method 15. The sample shall be extracted at a rate proportional to the gas velocity at the sampling point. Each run shall span a minimum of four consecutive hours of continuous sampling. A number of separate samples may be taken for each run provided the total sampling time of these samples adds up to a minimum of four consecutive hours. Where more than one sample is used, the average moisture content for the run shall be calculated as the time weighted average of the moisture content of each sample according to the formula:

$$B_{wo}=\sum_{i=1}^{N} B_{si}\left[\frac{t_{si}}{T}\right]$$

B_{wo} = Proportion by volume of water vapor in the gas stream for the run.
N = Number of samples.
B_{si} = Proportion by volume of water vapor in the gas stream for the sample i.
t_{si} = Continuous sampling time for sample i.
T = Total continuous sampling time of all N samples.

* * * * *

APPENDIX A—REFERENCE METHODS

7. Appendix A is amended by adding a new reference method as follows:

METHOD 15—DETERMINATION OF HYDROGEN SULFIDE, CARBONYL SULFIDE, AND CARBON DISULFIDE EMISSIONS FROM STATIONARY SOURCES

1. *Principle and applicability.* 1.1 Principle. A gas sample is extracted from the emission source and diluted with clean dry air. An aliquot of the diluted sample is then analysed for hydrogen sulfide (H_2S), carbonyl sulfide (COS), and carbon disulfide (CS_2) by gas chromatographic (GC) separation and flame photometric (FPS) detection.

1.2 Applicability. This method is applicable for determination of hydrogen sulfide, carbonyl sulfide, and carbon disulfide when specified by an applicable subpart.

2. *Range and sensitivity.* 2.1 Range. The maximum limit of the FPD for each sulfur compound is dependent on the sample size. For a 1 ml sample the upper limit is about 10 ppm. It may be necessary to dilute gas samples from sulfur recovery plants hundredfold (100:1), resulting in an upper limit of about 1000 ppm for each compound.

2.2 The minimum detectable concentration of the FPD is also dependent on sample size and would be about 0.5 ppm for a 1 ml sample.

3. *Interferences.* 3.1 Moisture Condensation. Moisture condensation in the sample delivery system, the analytical column, or the FPD burner block can cause losses or interferences. This potential is eliminated by heating the sample line, and by conditioning the sample with dry dilution air to lower its dew point below the operating temperature of the GC/FPD analytical system prior to analysis.

3.2 Carbon Monoxide and Carbon Dioxide. CO and CO_2 have a substantial densensitizing effect on the detector even after 10:1 dilution. This potential interferenc is eliminated by eluting CO and CO_2 with the "air peak" prior to elution of any sulfur compound.

3.3 Elemental Sulfur. The condensation of sulfur vapor in the sampling lines can lead to eventual coating and even blockage of the sample line. This problem can be eliminated along with the moisture problem by heating the sample line.

4. *Precision.* 4.1 Calibration Precision. A series of three consecutive injections of the same calibration gas, at any dilution, should product results which do not vary by more than ±3% from the mean of the three injection.

4.2 Calibration Drift. The calibration drift determined from the mean of three injections made at the beginning and end of any 8-hour period should not exceed ±3%.

5. *Sample apparatus.* 5.1.1 Sample probe—The sample probe should be fabricated from a suitable length and diameter of stainless steel tubing.

5.1.2 Sample line—0.48 cm (3/16 inch) inside diameter Dekoron FEP Teflon[1] tubing, heated to 120° C. This temperature is controlled by a thermostatic heater.

5.1.3 Sample pump—Leakless Teflon coated diaphragm type or equivalent. The pump head is heated to 120° C by enclosing it in the sample dilution box (5.2.4 below).

5.2 Dilution System. A schematic diagram of the dynamic dilution system is given in Figure 15-1. The dilution system is constructed such that all sample contacts are made of inert materials. The dilution system which is heated to 120° C must be capable of a minimum of 10:1 dilution of sample. Equipment used in the dilution system is listed below.

5.2.1 Dilution pump—Model A-150 Kombyr Teflon positive displacement type, non-adjustable 150 cc/min ±2.0%, or equivalent, per dilution stage. A 10:1 dilution of sample is accomplished by combining 150 cc of sample with 1350 cc of clean dry air as shown in Figure 15-1.

5.2.2 Valves—Threeway Teflon solenoid or manual type.

5.2.3 Tubing—Teflon tubing and fittings are used throughout from the sample probe to the GC/FPD to present an inert surface for sample gas.

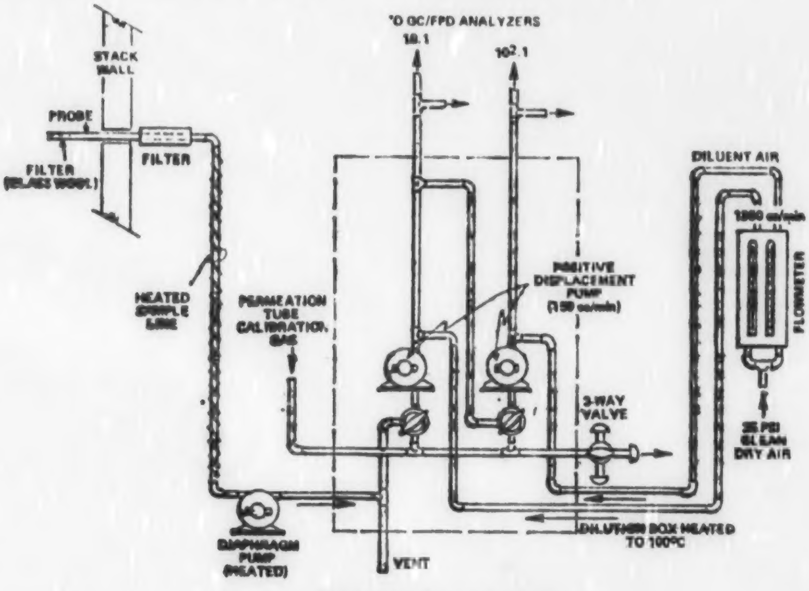

Figure 15.1. Sampling and Dilution Apparatus.

5.2.4 Box — Insulated box, heated and maintained at 120° C, of sufficient dimensions to house dilution apparatus.

5.2.5 Flowmeters—Rotameters or equivalent to measure flow from 0 to 1500 ml/min ±1% per dilution stage.

5.3 Gas Chromatograph.

5.3.1 Column—1.83 m (6 ft) length of Teflon tubing, 2.16 mm (0.085 in.) inside diameter, packed with deactivated silica gel, or equivalent.

5.3.2 Sample valve—Teflon six-port gas sampling valve equipped with a 10 ml sample loop, actuated by compressed air (Figure 15-2).

5.3.3 Oven—For containing sample valve, stripper column and separation column. The oven should be capable of maintaining an elevated temperature ranging from ambient to 100° C, constant with ±1° C.

5.3.4 Temperature monitor — Thermocouple pyrometer to measure column oven, detector, and exhaust temperature ±1° C.

5.3.5 Flow system—Gas metering system to measure sample flow, hydrogen flow, oxygen flow and nitrogen carrier gas flow.

5.3.6 5.3.6 Detector—Flame photometric detector.

5.3.7 Electrometer—Capable of full scale amplification of linear ranges of 10^{-9} to 10^{-4} amperes full scale.

5.3.8 Power supply—Capable of delivering up to 750 volts.

5.3.9 Recorder—Compatible with the output voltage range of the electrometer.

5.4 Calibration. Permeation tube system (Figure 15-3).

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[1] Mention of trade names or specific products does not constitute an endorsement by the Environmental Protection Agency.

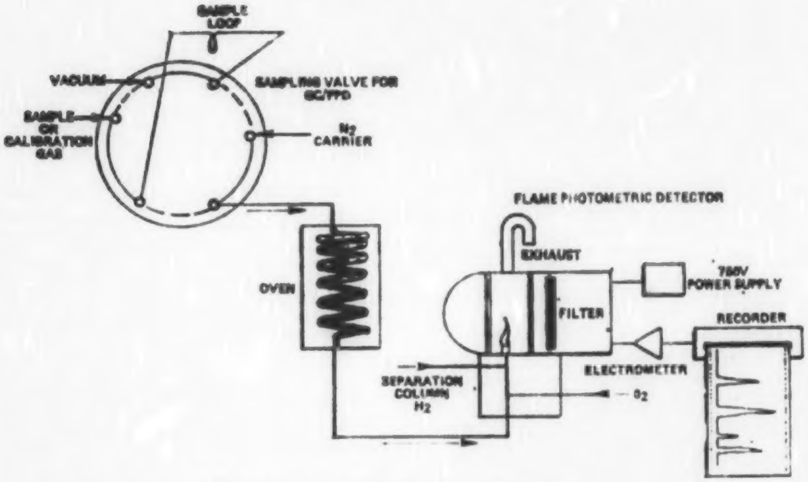

Figure 15-2 Gas Chromatographic Flame Photometric Analyzer.

5.4.1 Tube chamber — Glass chamber of sufficient dimensions to house permeation tubes.

5.4.2 Mass flowmeters — Two mass flowmeters in the range of 0–3 l/min and 0–10 l/min to measure air flow over permeation tubes at ±2%. These flowmeters shall be cross-calibrated at the beginning of each test with a known calibration gas (H_2S or other), comparing responses by GC/FPD. Each mass flowmeter shall be calibrated prior to the first test with a wet test meter and thereafter, at least once each year.

5.4.3 Constant temperature bath—Capable of maintaining permeation tubes at certification temperature at 30° C within ±0.1° C.

5.4.4 Temperature monitor—Thermometer or equivalent to monitor bath temperature within ±0.1° C.

6. *Reagents*. 6.1 Fuel. Hydrogen (H_2) prepurified grade or better.

6.2 Combustion Gas. Oxygen (O_2) prepurified grade or better.

6.3 Carrier Gas. Nitrogen (N_2) prepurified grade or better.

6.4 Diluent. Air containing less than 0.5 ppb total sulfur compounds and less than 10 ppm each of moisture and total hydrocarbons, and filtered using MSA filters 46727 and 79030 or equivalent. Removal of sulfur compounds can be verified by injecting dilution air only, described in Section 8.4.

6.5 Compressed Air. 60 psig for GC valve actuation.

6.6 Calibration Gases. Permeation tubes gravimetrically calibrated and certified at 30.0° C.

7. *Pre-test procedures*. 7.1 After the complete measurement system has been set up at the site and verified to be operational, the following procedures shall be completed before sampling is initiated.

7.1.1 Flowmeter calibration and leak test—Appropriate calibration and leak test procedures shall be employed to verify the accuracy and/or integrity of all flowmeters, sample lines, and connections. For components under negative presure (lines and connections upstream of the sample pump), a leak test is performed using the sample pump to pull a vacuum. Attach the probe end of the sample line to a manometer or vacuum gauge, start the pump and pull greater than 50 mm (2 in.) Hg vacuum. Close off the pump outlet, then stop the pump and ascertain that there is no leak for 5 minutes. For components subject to positive pressure, leak tests shall be performed at each joint by applying a liquid (detergent in water, for example) which will foam in the presence of a leak.

Since the complete dilution system and GC/FPD is calibrated prior to and following each test, the precise calibration of each component is not critical. However, these components should be verified to be operating properly. This verification can be performed by observing the response of flowmeters or of the GC output to changes in flow rates or calibration gas concentrations and ascertaining the response to be within predicted limits. If any component, or if the complete system fails to respond in a normal and predictable manner, the source of the discrepancy shall be identified and corrected before proceeding.

7.1.2 Mass flowmeter calibration—Since all sample calculations are based on the accuracy of air flow measured by the mass flowmeters, it is essential that the cross-calibration check of Section 5.4.2 be followed.

7.1.3 Prior to any sampling run, calibrate the system using the procedures set forth in Section 8. If more than one run is performed during any 24-hour period, a calibration need not be performed prior to the second and any subsequent runs. The calibration must, however, be verified as prescribed in Section 8, after the last run made within the 24-hour period.

8. *Calibration*. 8.1 General Considerations. This section outlines steps to be followed for use of the GC/FPD and the dilution system. The procedure does not include detailed instructions because operation of these systems is complex, and it requires an understanding of the individual system being used. Each system should include a written operating manual describing in detail the operating procedures associated with each component in the measurement system. In addition, the operator should be familiar with the operating principles of the components, particularly the GC/FPD. The references cited at the end of this method are recommended for review for this purpose.

8.2 Permeation Tubes. Under the following procedure, accurately known concentrations (±1%) of a variety of sulfur compounds are generated by passing clean dry air or other diluent gas over permeation tubes, each containing a specific sulfur compound as a permeant. These tubes consist of hermetically sealed FEP Teflon tubing in which a liquefied gaseous substance is enclosed. The enclosed gas permeates through the tubing wall at a constant rate. When the temperature is constant, calibration gases covering a wide range of known concentrations can be generated by varying and accurately measuring the flow rate of diluent gas passing over the tubes. These calibration gases are used to calibrate the GC/FPD system and the dilution system.

8.3 Calibration Procedure. Assemble the permeation tube calibration apparatus as depicted in Figure 15–3. Insert the permeation tubes into the glass tube chamber. Check the bath temperature to assure agreement with the calibration temperature of the tubes within ±1° C. A temperature of 30° C is recommended for the sulfur gas tubes. Allow several hours for the tubes to equilibrate. When equilibrated, vary the flow rate of diluent air flowing over the tubes to produce the desired concentrations for calibrating the analytical and dilution systems. The air flow across the tubes must at all times exceed the flow requirement of the analytical systems. The concentration in parts per million generated by a tube containing a specific permeant can be calculated as follows:

Equation 15-1

$$C = K\frac{P_r}{ML}$$

Where:

C = Concentration of permeant produced in ppm

P_r = Permeation rate of the tube in μg/min.

M = Molecular weight of the permeant $\left(\frac{g}{g\text{-mole}}\right)$.

L = Flow rate, l/min, of air over permeant @20° C, 760 mm Hg.

K = Gas constant at 20° C and 760 mm Hg = 24.04 l/g mole.

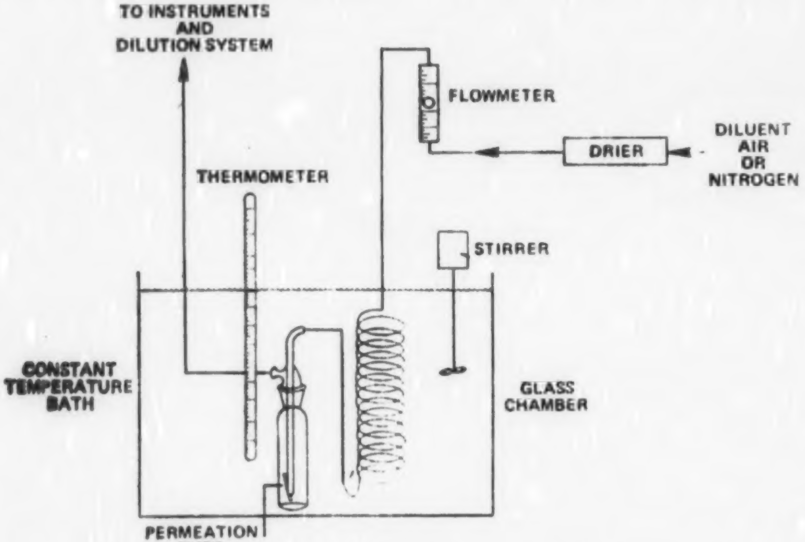

Figure 15-3. Apparatus for field calibration.

8.4 Operating Condition for GC/FPD System. The operation parameters for the GC/FPD system are as follows: nitrogen carrier gas flow rate of 100 cc/minute, exhaust temperature of 110° C, detector temperature of 105° C, oven temperature of 40° C, hydrogen flow rate of 80 cc/minute, oxygen flow rate of 20 cc/minute, and sample flow rate of 80 cc/minute.

8.5 Calibration of GC/FPD Analysis Systems. Generate a series of three or more known concentrations spanning the linear range of the RPD (approximately 0.05 to 1.0 ppm) for each sulfur compound anticipated to be present in the gas stream analyzed. Bypassing the dilution system, inject these standards into the GC/FPD analyzers and monitor the responses. Three injects for each concentration must yield the precision described in Section 4.1. Failure to attain this precision is an indication of a problem in the calibration or analytical system. Any such problem must be identified and corrected before proceeding. Peak heights, rather than integrated areas, have proven satisfactory; however, integrated areas may be required for alternate columns or instrumentation.

8.5.1 Calibration curves—Plot the GC/FPD responses in current (amperes) versus their causative concentrations in ppm on log-log coordinate graph paper for each sulfur compound calibrated.

8.6 Calibration of Dilution System. Generate a known concentration of hydrogen sulfide using the permeation tube system. Adjust the flow rate of diluent air for the first dilution stage so that the desired level of dilution is approximated. Inject the diluted calibration gas into the GC/FPD and monitor its response. Three injects for each dilution must yield the precision described in Section 4.1. Failure to attain this precision in this step is an indication of a problem in the dilution system. Any such problem must be identified and corrected before proceeding. Using the calibration curve for H_2S (developed under 8.5.1), determine the diluted calibration gas concentration in ppm. Then, calculate the dilution factor as the ratio of the calibration gas concentration before dilution to the diluted calibration gas concentration determined under this paragraph. Repeat this procedure for each stage of dilution required.

9. *Sampling and analysis procedure.*

9.1 Sampling. Insert the sampling probe into the test port making certain that no dilution air enters the stack through the port. Begin sampling and dilute the sample approximately 10:1 using the dilution system shown in Figure 15–1. Note that the precise dilution factor is that which is determined in paragraph 8.6. Condition the entire system with sample for a minimum of 15 minutes prior to commencing analysis.

9.2 Analysis. The sample value is actuated for one minute in which time an aliquot of diluted sample is injected onto separation column. The valve is then deactivated for the remainder of the analysis cycle in which time the sample loop is refilled and the separation column continues to be flushed. The elution time for each compound will be determined during calibration.

9.3 Sample Run A sample consists of one analysis (injection).

10. *Post-test procedures.*

10.1 Recalibration. After each run, or after a series of runs made within a 24-hour period, perform a partial recalibration using the procedures in Section 8. Only H_2S (or other permeant) need be used to recalibrate the GC/FPD analysis system (8.4) and the dilution system (8.5).

10.2 Determination of Calibration Drift. Compare the calibration curves obtained prior to the runs to the calibration curves obtained under paragraph 10.1. The calibration drift must not exceed the limits set forth in paragraph 4.2. If the drift exceeds this limit, the intervening run or runs shall be considered not valid.

11. *Calculations.*

11.1 Determine the concentrations of hydrogen sulfide, carbonyl sulfide, and carbon disulfide detected in each sample directly from the calibration curves.

11.2 Sulfur Dioxide Equivalent. For each sample the concentrations of hydrogen sulfide, carbonyl sulfide, and carbon disulfide are totaled and the sum expressed as sulfur dioxide using the following equation:

SO_2 equivalent = $[H_2S] + [COS] + 2[CS_2]$

SO_2 equivalent = The sum of the concentration of each of the measured compounds (H_2S, COS, CS_2) expressed as sulfur dioxide, in ppm.

$[H_2S]$ = Measured concentration of hydrogen sulfide, in ppm.

$[COS]$ = Measured concentration of carbonyl sulfide, in ppm.

$[CS_2]$ = Measured concentration of CS_2, in ppm.

12. *Bibliography.*

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[FR Doc.76–28711 Filed 10–1–76;8:45 am]

ENVIRONMENTAL PROTECTION AGENCY

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BASIC OXYGEN PROCESS FURNACES

Standards of Performance For New
Stationary Sources

SUBPART N

ENVIRONMENTAL PROTECTION AGENCY

[40 CFR Part 60]

[FRL 684-6]

STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Iron and Steel Plants: Basic Oxygen Process Furnaces

Notice is hereby given that under sections 111, 114, and 301 of the Clean Air Act, as amended, the Administrator is proposing amendments to the standards of performance for basic oxygen process furnaces (BOPF).

SUMMARY OF PROPOSED AMENDMENTS

The proposed amendments to the standards of performance for BOPF facilities would limit the opacity of emissions from the control device, require monitoring of operations of the control device, and clarify the term "startup" as it applies to BOPF facilities. Compliance with the proposed opacity limits would be determined by conducting observations in accordance with Reference Method 9. The continuous monitoring of operations is specific to venturi scrubber emission control equipment because all presently planned facilities will be controlled by venturi scrubbers. The proposed monitoring provisions require continuous monitoring of the pressure loss across the throat of the scrubber and the water supply pressure to the scrubber. As the provisions of 40 CFR 60.11(c) apply to BOPF facilities, "startup" means the setting into operation of a BOPF which has been out of production for a continuous time period of eight hours or the setting into operation of a relined BOPF.

BACKGROUND

On June 11, 1973 (38 FR 15406), the Administrator proposed as Subpart N to 40 CFR Part 60, standards of performance for new basic oxygen process furnaces (BOPFs). The proposed standards limited particulate matter emissions to no more than 50 mg/dscm (0.022 gr/dscf) and to less than 10 percent opacity except for two minutes in any one hour. Commenters on the proposed standards pointed out the inappropriateness of the two minutes per hour exemption for the cyclic steel production process and the unachievability of the level of the proposed opacity standard. Evaluation of the comments on the proposed standard led EPA to conclude that further study was required for development of adequate provisions. On March 8, 1974 (39 FR 9308), the Administrator promulgated the standard of performance limiting emissions from new BOPFs to less than 50 mg/dscm; however, the opacity standard and the attendant continuous monitoring requirement were not promulgated at that time. The opacity standard was reserved pending study of (1) the reasons for the observed variations in the opacity of emissions from well-controlled facilities and (2) the effect that exempting periods of startup, shutdown, and malfunction from applicability of opacity standards would have on the level of the opacity standard and the need for a time exemption.

On November 12, 1974 (39 FR 39872), EPA revised Reference Method 9 and the general provisions applicable to opacity standards of performance. Reference Method 9, the method for determining compliance with opacity standards, was revised to require that opacity observations be recorded at 15-second intervals with a minimum of 24 observations (six minutes), to obtain sufficient observations to ensure acceptable accuracy. The use of sets of opacity observations (or six-minute average opacity values) precludes a single high reading from being considered a violation. In addition, § 60.11(e) was added to the general provisions to provide a means for an owner or operator to petition EPA to obtain a higher opacity standard for any facility that demonstrates compliance with the mass standard concurrent with failure to achieve the opacity standard. Section 60.11(e) allows opacity standards to be established at levels which reflect the maximum expected effects of the normal range of operating variables and stack diameters at well-controlled new facilities.

In light of the Method 9 revisions and the questions on the appropriate emission limitation and format for the opacity standard, additional opacity data were obtained and the bases and rationale for an opacity standard for BOPFs were thoroughly reevaluated. The reevaluation included consideration of the effects on opacity of process variations, of variations in performance characteristics of control devices, and of definition of startup periods for BOPFs. The proposed opacity standards are established at levels which are achievable by well-maintained and properly operated control equipment capable of reducing emissions to the level of the concentration standard, 50 mg/dscm (0.22 gr/dscf). Copies of the report on the data bases and rationale for the proposed opacity standard may be obtained upon written request from the EPA Public Information Center (PM-215), Environmental Protection Agency, Washington, D.C. 20460 (specify: Background Information for an Opacity Standard of Performance for Basic Oxygen Process Furnaces in Iron and Steel Plants).

ENVIRONMENTAL AND INFLATIONARY IMPACT

Opacity standards are set at levels which ensure proper operation and maintenance of the control system, but which do not require use of a more efficient system. The opacity standards and the continuous monitoring requirements proposed herein do not impose any additional significant requirements or costs over those required to comply with the concentration standard. Therefore, this proposal is not considered a major action under the Inflationary Impact Statement (IIS) program and no IIS is required. The environmental impacts of the standards of performance for BOPFs also are incurred in complying with the concentration standard. During the development of the concentration standard, the intermedia effects of the standard were assessed and determined to be negligible. No additional intermedia effects would be incurred in complying with opacity standards for BOPFs. Therefore, a formal environmental impact statement has not been prepared. The environmental impact of the proposed opacity standards is beneficial as the standards would ensure compliance of new BOPFs with the concentration standard throughout their operational life.

DATA BASE FOR A STANDARD

The standard of performance limits emissions from all new basic oxygen process furnaces to less than 50 mg/dscm (0,22 gr/dscm). Emissions from basic oxygen process furnaces can be controlled to this level by use of a well-designed and operated high energy venturi scrubber or an electrostatic precipitator. In the development of an opacity standard for BOPFs, opacity observations were conducted at six facilities according to the procedures of Method 9 (39 FR 39872). Because of a known difference between the particle size distributions, and hence light scattering properties, of emissions from bottom blown BOPFs and top blown BOPFs, the opacity of emissions from both type furnaces were investigated in the background study on a standard.

The facilities observed in the study were representative of several control levels based on available particulate matter emission data and an engineering judgment of the current condition of the control system. The condition of the control system was assessed on the basis of review of operating parameters, design parameters, and maintenance condition of the control system. From the observation of six facilities, it was noted that higher emissions occurred at the beginning of the steel production cycle for both types of control systems. The higher opacity emissions are attributable to the greater evolution rate of particulate matter and the lower gas temperature at the start of the oxygen blow as well as a lag in the response of the control device. For scrubber-controlled top or botton blown BOPFs the six minute average opacity levels observed at the start of oxygen blow were less than 20 percent, and the six minute average opacity levels during the remainder of the cycle were less than 10 percent opacity. Electrostatic precipitator controlled facilities exhibited opacity levels less than 30 percent during the start of oxygen blow and levels less than 16 percent during the remainder of the cycle. The difference between the opacity levels observed for the two types of control systems primarily reflects differences in diameter of discharge stacks rather than significant differences in the performance.

RATIONALE FOR THE PROPOSED STANDARD

Section 111 of the Act requires EPA to set emission standards which reflect "the degree of emission limitation achievable through application of the best system of emission reduction which (taking into account the cost of achieving such reduction) the Administrator determines has been adequately demonstrated." The standards of performance require an owner or operator to conduct a performance test after the initial startup of an affected facility to ensure that the control system was properly designed and installed. Section 111(e) of the Act requires that new sources continue to be in compliance with the standards throughout their operational life. Opacity standards are established in conjunction with mass or concentration standards as a means of ensuring that control equipment is adequately maintained and properly operated at all times between performance tests.

In EPA's judgment, the opacity levels associated with well-designed and operated facilities differed by type of control system due to design features. Therefore, selection of the emission limitation for the standard required consideration of whether the level would ensure proper operation and maintenance of all facilities. In the development of the proposed standard EPA considered several alternative regulatory approaches. The alternatives considered included opacity levels based on data from electrostatic precipitator-controlled facilities, separate opacity limitations for electrostatic precipitator-controlled and scrubber-controlled facilities, and an opacity level based on data from scrubber-controlled facilities. An opacity standard based on performance of electrostatic precipitator-controlled systems was not selected because the standard would not require proper operation and maintenance of venturi scrubber-controlled facilities. In addition, the steel industry currently has no plans for the construction of any new electrostatic precipitator-controlled BOPF facilities, thus this standard would not accomplish its intended purpose. Setting separate opacity standards for the two control systems was also rejected because only one of the control systems is expected to be used. Thus the proposed opacity standard is based on the performance of scrubber-controlled facilities. Should any affected BOPF be controlled with an electrostatic precipitator and comply with the particulate limit of 50 mg/dscm but not the opacity limits, a separate opacity limit would be established for that facility under 40 CFR 60.11(e). The provisions of 40 CFR 60.11(e) allow owners or operators of sources which exceed the opacity standard while concurrently achieving the concentration standard to request establishment of a specific opacity standard for that facility.

The proposed standard would limit peak opacity which occurs at the beginning of the cycle and the opacity over the remainder of the cycle. The opacity limit for the beginning of the cycle is necessary because of the increased particulate loading and gas density at the startup of the operation. Emissions during the period of startup of the production cycle are not excluded from the opacity standard as a "startup" under the provisions of 40 CFR 60.11(c) because emissions during this period are subject to the concentration standard and are controllable.

The proposed standard would limit emissions during the beginning of the production cycle to less than 20 percent opacity and emissions over the remainder of the cycle to less than 10 percent opacity. To simplify enforcement, the opacity standard would allow the period of higher opacity emissions to occur once per steel production cycle. Restriction of the higher opacity emission period to the beginning of the production cycle would require the observer to synchronize observations with shop operations. In addition, the proposed standard could be enforced more readily at facilities with several furnaces ducted to a single, common control system.

Standards of performance for new sources established under section 111 of the Clean Air Act reflect emission limits achievable with the best adequately demonstrated systems of emission reduction considering the cost of such systems. State implementation plans (SIP's) approved or promulgated under section 110 of the Act, on the other hand, must provide for the attainment and maintenance of national ambient air quality standards (NAAQS) designed to protect public health and welfare. For that purpose SIP's must in some cases require greater emission reductions than those required by standards of performance for new sources. In addition, States are free under section 116 of the Act to establish more stringent emission limits than those established under section 111 or those necessary to attain or maintain the NAAQS under section 110. Thus, new and existing sources may in some cases be subject to limitations more stringent than EPA's standards of performance under section 111.

PUBLIC PARTICIPATION

In accordance with section 117(f) of the Act, publication of these proposed amendments to 40 CFR Part 60 was preceded by consultation with appropriate advisory committees, independent experts, and Federal departments and agencies. Interested persons may participate in this rulemaking by submitting written comments (in triplicate) to the Emission Standards and Engineering Division, Environmental Protection Agency, Research Triangle Park, North Carolina, 27711, Attention: Mr. Don R. Goodwin. Comments on all aspects of the proposed amendments to the regulation are welcome, including economic and technological issues. All comments received not later than May 2, 1977, will be considered. Comments received will be available for public inspection at the EPA Public Information Reference Unit (EPA Library), Room 2922, 401 M. Street, SW., Washington, D.C. 20460.

(Sec. 111, 114, 301(a), Clean Air Act, as amended, Pub. L. 91-604, 84 Stat. 1678 (42 U.S.C. 1857c-6, 1857c-9, 1857g(a)).)

NOTE.—The Environmental Protection Agency has determined that this document does not contain a major proposal requiring preparation of an Economic Impact Statement under Executive Order 11949

Dated: February 23, 1977.

JOHN QUARLES,
Acting Administrator.

It is proposed to amend Part 60 of Chapter I, Title 40 of the Code of Federal Regulations as follows:

1. The table of sections is amended by revising Subpart N as follows:

Subpart N—Standards of Performance for Iron and Steel Plants

* * * * *

Sec.
60.143 Monitoring of operations.

* * * * *

2. Section 60.3 is amended by adding a new abbreviation as follows:

§ 60.3 Abbreviations.

* * * * *

Pa—pascal.

* * * * *

Subpart N—Standards of Performance for Iron and Steel Plants

3. Section 60.142 is amended by adding paragraph (a)(2) and (b) as follows:

§ 60.142 Standard for particulate matter.

(a) * * *

* * * * *

(2) Exit from a control device and exhibit 10 percent opacity or greater, except that an opacity of greater than 10 percent but less than 20 percent may occur once per steel production cycle.

(b) For purposes of this subpart, "startup" means the setting into operation of a BOPF which has been out of production for a minimum continuous time period of eight hours or the setting into operation of a relined BOPF.

4. A new § 60.143 is added as follows:

§ 60.143 Monitoring of operations.

(a) The owner or operator of an affected facility shall maintain daily records of the time and duration of each steel production cycle.

(b) The owner or operator of any affected facility that uses venturi scrubber emission control equipment shall install, calibrate, maintain, and continuously operate the following monitoring devices:

(1) A monitoring device for the continuous measurement of the pressure loss through the venturi construction of the control equipment. The monitoring device is to be certified by the manufacturer to be accurate within ±250 Pa (±1 inch water).

(2) A monitoring device for the continuous measurement of the water supply pressure to the control equipment. The monitoring device is to be certified by the manufacturer to be accurate within ±5 percent of the design water supply pressure. The pressure sensor or tap must be located close to the water discharge point. The Administrator may be consulted for approval of alternative locations for the pressure sensor or tap.

(c) All monitoring devices required under paragraph (b) of this section are to be recalibrated annually, and at other times as the Administrator may require, in accordance with the procedures under § 60.13(b)(3).

(d) Any owner or operator subject to requirements under paragraph (b) of this section shall report for each calendar quarter all measurement results that are more than 10 percent below the average levels maintained during the most recent performance test conducted under § 60.8 which the affected facility demonstrated compliance with the standard under § 60.142(a)(1). The accuracy of the respective measurements, not to exceed the values specified in paragraphs (b)(1) and (b)(2) of this section, may be taken into consideration when determining the measurement results that must be reported.

(Secs. 111, 114, 301(a), Clean Air Act, as amended, Pub. L. 91-604, 84 Stat. 1676 (42 U.S.C. 1857c-6, 1857c-9, 1857g(a)).)

[FR Doc.77-6082 Filed 3-1-77;8:45 am]

ENVIRONMENTAL PROTECTION AGENCY

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STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

SEWAGE TREATMENT PLANTS

SUBPART O

ENVIRONMENTAL PROTECTION AGENCY

[FRL 639-1]

[40 CFR Part 60]

STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Sewage Sludge Incinerators

Subpart 0 sets forth standards of performance for new, modified, and reconstructed sewage sludge incinerators in sewage treatment plants. The standards limit emissions of particulate matter to 0.65 g/kg dry sludge input (1.30 lb/ton dry sludge input) and visible emissions to 20 percent opacity. The State of Alaska recently requested EPA to revise § 60.150 of the regulation. The basis of the request is that incinerators which are small enough to meet the needs of small communities in Alaska and also comply with the particulate matter standard are not available, and the disposal of sewage sludge in landfills is not a viable option because of permafrost and other factors resulting in landfill problems (shallow and soft landfills). The proposed amendment would exempt incinerators with a capacity of less than 140 kg/hr (300 lb/hr) dry sludge provided that disposal by land application or sanitary landfill are shown to be infeasible because of freezing conditions.

BACKGROUND

The standards of performance for sewage sludge incinerators were promulgated March 8, 1974 (39 FR 9308), under section 111 of the Clean Air Act. Section 111 directs the Administrator to establish standards of performance for new stationary sources which reflect the degree of emission limitation achievable through the application of the best system of emission reduction which (taking into account the cost of achieving such reduction) the Administrator determines has been adequately demonstrated. The best system of emission reduction for sewage sludge incinerators (multiple hearth and fluid bed reactor type incinerators) was determined to be low energy venturi scrubbers.

At the time the standards were promulgated EPA was developing a standard for murcury emissions from sewage sludge incinerators and guidelines for municipal sludge management. The standard limiting mercury emissions was promulgated under section 112 (Hazardous Air Pollutants) of the Clean Air Act on October 14, 1975 (40 FR 48302), and the proposed guideline was issued for public comment on June 3, 1976, under the title "Technical Bulletin on Municipal Sludge Management: Environmental Factors."

Incineration is just one of several methods available for sludge disposal. The standards, which limit emissions of mercury and particulate matter, insure that adequate emission control systems are employed when incineration is used as the method of sludge disposal. Incineration is only a volume reduction method. After incineration, the ash, either dry or in scrubber water, remains to be disposed of to the land. Ash disposal must be designed to protect ground water, to prevent dust, and to insure no erosion to surface waters.

INVESTIGATION

In investigating Alaska's request, EPA contacted the vendors of sewage sludge incinerators and found that multiple hearth or fluid bed reactor type incinerators which can achieve the particulate matter standard are not commercially available below a size capacity of 140 kg/hr (300 lb/hr). This means that incineration would not be a disposal option where units smaller than 140 kg/hr are needed. Since the unique problems in parts of Alaska also prevent disposal by land application or sanitary landfill, sludge disposal cannot be accomplished in an environmentally acceptable mnaner under existing regulations. EPA concluded that a revision to the standards of performance for sludge incinerators is appropriate.

In developing a revision to the standard to accommodate the unique problems in parts of Alaska, EPA intends that the proposed exemption not create an incentive to utilize small incinerators which would not be covered under the standard. To avoid this situation the proposed exemption applies only where an owner or operator can demonstrate to the satisfaction of the Administrator that land application and sanitary landfills are not feasible disposal methods for the sewage sludge. The size exemption is based on the capacity of the waste water treatment plant rather than the incinerator in order to prevent constructing multiple small incinerators rather than larger units which would be subject to the standard.

The proposed amendment of § 60.150 would not affect applicable national mercury emission standards under § 61.50 which currently regulates mercury emissions from all sludge incinerators. These standards are not subject to the exemption because control of mercury emissions can be achieved by ordinances or statutes which prevent mercury-bearing material from being introduced into the municipal waste treatment system.

PUBLIC PARTICIPATION

Interested persons may participate in this proposed rulemaking by submitting written comments (in triplicate) to the Emission Standards and Engineering Division, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711, Attention: Mr. Don R. Goodwin. Comments on all aspects of the proposed revision are welcome. All relevant comments received not later than March 15, 1977 will be considered. Comments received will be available for public inspection and copying at the EPA Public Information Reference Unit, Room 2922 (EPA Library), 401 M Street, S.W., Washington, D.C. 20460.

AUTHORITY: Sections 111, 114, and 301(a) of the Clean Air Act, as amended by sec. 4(a) of Pub. L. 91-604, 84 Stat. 1678 and by sec. 15(c)(2) of Pub. L. 91-604, 84 Stat. 1713 [42 U.S.C. 1857c-6, 1857c-9 and 1857g(a)].

Dated: January 14, 1977.

RUSSELL E. TRAIN,
Administrator.

In 40 CFR Part 60, it is proposed to amend Subpart 0, by revising § 60.150 as follows:

§ 60.150 Applicability and designation of affected facility.

(a) The affected facility to which the provisions of this subpart apply is each incinerator which combusts the sludge produced by municipal sewage treatment plants except as provided under paragraph (b) of this section.

(b) The owner or operator of a sewage sludge incinerator may apply to the Administrator for an exemption to the requirements of this subpart for any sewage sludge incinerator that is in a municipal waste treatment plant having a dry sludge capacity below 140 kg/hr (300 lb/hr). The Administrator will grant an exemption provided the owner or operator demonstrates to the Administrator's satisfaction that it is not feasible to dispose of the sludge by land application or in a sanitary landfill because of freezing conditions. For the purpose of determining the capacity of a municipal waste treatment plant under this paragraph, the dry sludge capacity of the municipal waste treatment plant or the dry sludge capacity of the sewage sludge incinerator, whichever is greater, is used.

[FR Doc.77-2384 Filed 1-25-77;8:45 am]

ENVIRONMENTAL PROTECTION AGENCY

[40 CFR Part 60]

[FRL 689-5]

STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Sewage Treatment Plants: Correction

On January 26, 1977 (42 FR 4863), EPA published a proposed amendment to Subpart 0 of 40 CFR Part 60. By this notice EPA makes certain administrative changes to the proposed amendment and requests that interested persons comment on the amendment as published here rather than as published on January 26, 1977. The amendment proposed here retains the exemption for any sewage sludge incinerator which is located at a municipal waste treatment plant having a dry sludge capacity below 140 kg/hr (300 lb/hr) and where it is not feasible to dispose of the sludge by land application or in a sanitary landfill because of freezing conditions. However, the amendment proposed here does not require the owner or operator to demonstrate to the satisfaction of the Administrator that such conditions exist, as was required by the amendment proposed on January 26. Rather, the procedures already established under 40 CFR 60.4 and 60.5 are available for an owner or operator of a sewage sludge incinerator to request an EPA determination of whether such an incinerator is an affected facility under these regulations.

Comments on the proposed amendment published here will be due on March 15, 1977, which is the same due date as for the amendment published on January 26, 1977.

(Secs. 111, 114, 301(a), Clean Air Act, as amended, Pub. L. 91-604, 84 Stat. 1678 (42 U.S.C. 1857c-6, 1957c-9, 1857g(a)).)

In 40 CFR Part 60, it is proposed to amend Subpart 0, by revising § 60.150 as follows:

§ 60.150 Applicability and designation of affected facility.

(a) The affected facility to which the provisions of this subpart apply is each incinerator which combusts the sludge produced by municipal sewage treatment plants except any such incinerator which is located at a municipal waste treatment plant having a dry sludge capacity below 140 kg/hr (300 lb/hr) and where it is not feasible to dispose of the sludge by land application or in a sanitary landfill because of freezing conditions.

(b) For the purpose of determining the capacity of a municipal waste treatment plant under this paragraph, the dry sludge capacity of the municipal waste treatment plant or the dry sludge capacity of the sewage sludge incinerator, whichever is greater, is used.

* * * * *

(Secs. 111, 114, 301(a), Clean Air Act, as amended, Pub. L. 91-604, 84 Stat. 1678 (42 U.S.C. 1857c-6 1857c-9, 1857g(a)).)

Date: February 11, 1977.

EDWARD F. TUERK,
Acting Assistant Administrator for Air and Waste Management.

NOTE.—The Environmental Protection Agency has determined that this document does not contain a major proposal requiring preparation of an Economic Impact Statement under Executive Order 11949.

[FR Doc.77-5078 Filed 2-17-77;8:45 am]

ENVIRONMENTAL PROTECTION AGENCY

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STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Kraft Pulp Mills

SUBPART BB

ENVIRONMENTAL PROTECTION AGENCY

[40 CFR Part 60]

[FRL 605-2]

KRAFT PULP MILLS

Standards of Performance for New Stationary Sources

Notice is hereby given that under the authority of section 111 of the Clean Air Act, as amended, the Administrator is proposing standards of performance for new and modified kraft pulp mills. The Administrator also is proposing to amend Appendix A, Reference Methods, in Part 60 by adding a reference method for the measurement of total reduced sulfur (TRS) emissions and an alternate method for the measurement of particulate matter.

PROPOSED STANDARDS

The proposed standards would limit emissions of particulate matter from three affected facilities at kraft pulp mills. The limits are: (1) 0.10 gram per dry standard cubic meter (g/dscm) for recovery furnaces, (2) 0.15 gram per kilogram of air-dried pulp (g/kg ADP) for smelt dissolving tanks, (3) 0.15 g/dscm for lime kilns when burning natural gas, and (4) 0.30 g/dscm for lime kilns when burning oil. Visible emissions from recovery furnaces would be limited to 35 percent opacity.

Under the proposed standards, TRS emissions would be limited to 5 parts per million (ppm) by volume from seven affected facilities: Digester systems, brown stock washer systems, multiple-effect evaporator systems, black liquor oxidation systems, recovery furnaces, lime kilns, and condensate stripper systems. In addition, a TRS standard of 0.025 g/kg ADP is proposed for smelt dissolving tanks.

ENVIRONMENTAL IMPACT

The proposed standards would reduce particulate emissions from new kraft pulp mills more than 99 percent below the levels that would result from no control and more than 50 percent below the average levels that are being achieved by typical existing facilities in the United States. Emissions of TRS would be reduced by more than 95 percent below the uncontrolled levels and more than 80 percent below the average levels for existing sources.

TRS emissions from kraft pulp mills are extremely odorous, and there are numerous instances of poorly controlled kraft mills creating public odor problems. The proposed standards include limitations on TRS emissions, rather than on the intensity of odors produced by kraft pulp mills, because this course of action would ensure more objective and efficient enforcement. The proposed standards would prevent odor problems from most newly constructed kraft pulp mills, except in the immediate vicinity of the mills on occasions when meteorological conditions produce downwash of stack plumes. The proposed standards would substantially reduce ground level ambient air concentrations of particulate matter around new kraft pulp mills below current levels found around existing mills.

The secondary environmental impact of the proposed standards would be minor. No additional solid waste handling or disposal problems would be caused by the standards because the additional particulate matter collected from recovery furnace systems, smelt dissolving tanks, and lime kilns can be recycled to the kraft pulping process. Increased water demand and treatment would be slight because mill process water can be used in scrubbing systems for lime kilns and smelt dissolving tanks, and the scrubbing system effluent could be recirculated to the kraft pulping process with no increased effluent. The increased mud washing necessitated by the standard could increase water demand. A relatively small amount of particulate matter, sulfur dioxide, and nitrogen oxides would be discharged into the air if the power plant that supplies the additional electrical power required by the standards is fired with fossil fuel.

ENERGY IMPACT

The energy requirements of the proposed standards have been evaluated. Compared to the requirements of the average State standards, the incremental energy that would be required to control all new, modified, and replaced affected facilities at kraft pulp mills by 1981 has been estimated at an equivalent of about 1,440,000 barrels of Number 6 fuel oil per year. The magnitude of this requirement indicates that the proposed standards would not have a major impact on the imbalance between national energy demand and domestic supply.

The incremental energy requirements of the proposed standards would be generated by the use of fans or pumps to circulate exhaust gases or scrubbing liquids through control devices, and the direct consumption of natural gas or fuel oil to incinerate exhaust gases or maintain process conditions that reduce the generation of pollutants. The incremental energy represents an increase of approximately 4.3 percent above the process energy requirements for new kraft pulp mills.

ECONOMIC IMPACT

The proposed regulations could affect an estimated 17 million tons of kraft pulping capacity by 1981. About a third of that capacity would be affected as a result of mill capacity expansions. The remainder would be affected via replacement of depreciated designated facilities. It is projected that the equivalent of 33 new mills or expansions at existing mills, with a capacity of 500 T ADP/day, will occur through 1980. Replacement of existing depreciated designated facilities will result at an estimated 35 mills.

Total incremental investment costs through 1981 are projected to be $104 million. The fifth-year annualized costs, including depreciation and interest, are estimated at $33 million. About a third of these costs would be incurred by mills expanding capacity, while the remainder would be incurred by mills replacing depreciated designated facilities.

The costs that new, modified, and reconstructed kraft pulp mills would incur to comply with the proposed standards are considered reasonable. No difference in impact among mill sizes could be distinguished, and the proposed standards would not have an adverse impact on either small or large mills. The capital required for typical new mills would be increased by less than 2 percent, and the price of semi-bleached kraft pulp would be increased by less than 2 percent. The effect the proposed standards would have on demand and supply of kraft pulp and on the future growth of the kraft pulp industry is considered negligible. It is emphasized that the costs are considered reasonable for new and modified sources and that it is not implied that the same costs apply to the retrofitting of existing sources. The review of the economic impact has shown that the proposal is not a major action under the Inflationary Impact Statement (IIS) program and no IIS is needed.

SELECTION OF SOURCE CATEGORY AND AFFECTED FACILITIES

Section 111 of the Act directs the Administrator to establish standards of performance for stationary sources that may contribute significantly to air pollution which causes or contributes to the endangerment of public health or welfare. Kraft pulp mills are a major source of TRS compounds and particulate matter emissions. TRS compounds can have an adverse effect on public welfare, and particulate matter can have an adverse effect on public health and welfare. Kraft pulp mills were selected for the development of standards based on expected growth of the industry and the beneficial impact that would result from the application of best technology for air pollution control. Kraft pulping has historically been a rapidly growing industry, with a growth rate of 5.5 percent per year between 1956 and 1975. The annual growth rate for 1976 to 1978 is projected to be 2.5 percent, but estimates show that the growth rate may return to a higher rate in 1979.

TRS emissions from kraft pulp mills are composed primarily of hydrogen sulfide, methyl mercaptan, dimethyl sulfide, and dimethyl disulfide. These sulfide compounds are extremely odorous and exhibit odor threshold concentrations of no more than a few parts per billion. A study of the national social and economic impacts of odors performed in 1971–1973 by Copley International Corporation for EPA found that the pulp and paper industry ranks in the upper quarter of all odor sources in terms of strength and public objection to the odors. The emissions from each pulp mill surveyed in the study affect an average of 44,000 persons over an area of approximately 100 square miles. The survey of 184 local air pollution control agencies in the United States ranked the pulp and paper source category as the fastest growing odor problem.

The establishment of standards of performance for TRS emissions from kraft pulp mills under section 111 of the Act would involve section 111(d) which provides for control of any air pollutants which are not on lists published pursuant to section 108(a) or 112(b)(1)(A) of the Act. TRS has not been named on either list. Specifically, section 111(d) requires that the Administrator prescribe a procedure to assure that States develop, implement, and enforce emission standards for existing sources that would be subject to the standard of performance if they were new sources. EPA promulgated regulations that establish procedures and requirements for submittal of State plans under section 111(d) on November 17, 1975 (40 FR 53339). As a consequence of the provisions of section 111(d), promulgation of this standard of performance for new and modified sources would require that the States develop emission standards for existing kraft pulp mills.

The proposed standards would apply to all process gas streams which have been identified as major sources of TRS compounds or particulate matter at kraft pulp mills. The following affected facilities are specified by the proposed standards: (1) Digester system, (2) brown stock washer system, (3) multiple-effect evaporator system, (4) black liquor oxidation system, (5) recovery furnace, (6) smelt dissolving tank, (7) lime kiln, and (8) condensate stripping system.

Water treatment ponds are significant sources of TRS emissions at some kraft pulp mills. Evaluations of odors in the immediate vicinity of mills indicate that TRS emissions from these ponds vary considerably from source to source, and do not produce an odor problem at some mills. Methods for measuring TRS emissions from kraft pulp mill water treatment ponds are not available at this time, and the proposed standards would not apply to these facilities. Emissions from ponds can be avoided by treating the process condensate stream in a condensate stripper system prior to discharge into the pond, but bacterial action could generate additional TRS in some ponds. EPA intends to further investigate measurement and emission control methods for water treatment ponds at kraft pulp mills, and determine whether regulation under the performance standard is appropriate.

Bark and power boilers are two sources of particulate emissions at kraft pulp mills that are not covered by the proposed standards. EPA plans to develop new source performance standards for industrial boilers, and this source category will include boilers at kraft pulp mills.

RATIONALE

The bases for the proposed standards include include information derived from (1) available technical literature on the kraft pulping industry and emission control of the kraft pulping process, (2) published studies sponsored by EPA of emission control of the kraft pulping process, (3) information gathered during visits to pollution control agencies and kraft pulp mills in the United States, (4) comments and suggestions solicited from experts, and (5) the results of measurements of emissions conducted by EPA and by the industry. The proposed standards for TRS emissions would require combinations of several control methods:

1. Use of improved process operating procedures to reduce the generation of TRS, such as control of the black liquor firing rate, the oxygen concentration within the furnace, and the air-to-solids ratio during operation (recovery furnace); more efficient mud washing and control of temperature and oxygen concentration (lime kiln); and use of clean water that is low in dissolved sulfides in the particulate scrubber (smelt dissolving tank).

2. Use of process equipment such as the indirect-contact evaporator system or black liquor oxidation system that inherently reduces the generation of TRS (recovery furnance system).

3. Use of control equipment such as scrubbers with caustic solution to collect TRS (lime kiln).

4. Use of incineration to convert TRS into less objectionable compounds (digester system, brown stock washer system, multiple-effect evaporator system, black liquor oxidation system, and condensate stripper system).

RECOVERY FURNACE

The recovery furnace is the largest single source of particulate matter and TRS at a kraft pulp mill. In the direct-contact conventional furnace, heat is recovered by directly contacting the furnace combustion gases with black liquor in a direct-contact evaporator. Most of the TRS discharged from direct-contact recovery furnaces is generated in the direct-contact evaporator, which also collects an appreciable portion of the particulate matter generated by the combustion of black liquor in the furnace.

The two methods for reducing TRS emissions from recovery furnaces are: (1) The use of a black liquor oxidation system to reduce the sodium sulfide content of the black liquor before evaporation in a direct-contact evaporator, and thereby the formation of TRS in the direct-contact evaporator, and (2) the elimination of the direct-contact evaporator in an indirect-contact recovery furnace. Since comparable emission levels of TRS can be achieved by these two control methods, the proposed standards could be attained by using either type of recovery furnace. However, the proposed emission limit of 5 ppm TRS, four-hour average, is lower than that being achieved by some existing recovery furnaces of either type and would therefore require more careful operation and additional black liquor oxidation for comparable new furnaces.

Electrostatic precipitators (ESP's) are used almost universally to control particulate matter emissions from kraft recovery furnaces. Scrubbers with relatively low collection efficiencies are in use at a few facilities. Tests performed by EPA demonstrate that the proposed particulate standard could be achieved by a properly designed and well maintained ESP.

The industry has stated that ESP's operated on kraft recovery furnaces significantly deteriorate over the life of the ESP even when it is well maintained. In response, EPA obtained information from mill operators and vendors of ESP's and concluded that good maintenance of wires, collection plates, and rapping systems would ensure that particulate matter emissions from a properly designed and operated ESP would not increase to a large extent over the life of the ESP. EPA recognizes that ESP's for kraft recovery furnaces must withstand more severe service than for some other applications. Accordingly, the proposed standards would require the more ruggedly designed ESP's in order to accommodate, for example, the more severe plate rapping and stressing of wires experienced at kraft pulp mills. The additional cost of the more ruggedly designed ESP was included in the economic analysis and is considered to be reasonable.

The industry has also stated that the performance of ESP's operated on kraft recovery furnaces should be allowed to deteriorate until there is a sufficient amount of maintenance to be performed that the necessary shutdown of the furnace would be justified. EPA believes that this is a reasonable approach. Accordingly, the proposed particulate matter standard for recovery furnaces would allow some deterioration; the proposed emission limit has been set somewhat higher than the levels known to be achievable on the basis of both the results of particulate matter tests performed by EPA and design levels for new kraft recovery furnace ESP's.

EPA has determined that an oxygen concentration in excess of 8 percent in the gas stream measured after the recovery furnace control device represents excessive air inleakage and results in excessive dilution of the gas stream. The proposed standard, therefore, requires that all concentrations of particulate matter and TRS measured after the recovery furnace control device that have an oxygen concentration in excess of 8 percent be corrected to 8 percent oxygen.

LIME KILN

Lime kilns are a major source of particulate matter emissions at kraft pulp mills. Because the lime mud that is processed in the kiln contains residual quantities of sulfides, lime kilns are also sources of TRS emissions.

The two methods for controlling TRS emissions from lime kilns are: (1) more efficient washing to reduce the sulfide content of the lime mud, and control of kiln exhaust gas temperature and oxygen content, and (2) use of sodium hydroxide (caustic) in the scrubber that controls particulate emissions from most kilns. Tests carried out by EPA demonstrate that when the first TRS control method (process control) is applied, the simultaneous addition of caustic to a scrubber produces a significant reduction in TRS emissions below that achievable with process control alone. The annualized cost for caustic addition to the scrubber is small where the caustic is not part of the make-up in the kraft causticizing system. Accordingly, the proposed standard of 5 ppm TRS, four-hour average, would require both the best process controls for lime kiln operation and caustic addition to the scrubber, or an equivalent system.

In developing the proposed standards, EPA carried out six tests for particulate emissions from lime kilns. In each case the control device for particulate matter was a medium pressure drop scrubber, the most widely used control technique in the domestic industry. However, one domestic kraft pulp mill controls particulate emissions with an electrostatic precipitator. Based on design parameters and emission data supplied by the operator of this ESP, this system achieves an emission level significantly below that determined by EPA for medium pressure drop scrubbers. However, the waste gases from the digester system and multiple-effect evaporator system, which could more economically be incinerated in the lime kiln, are processed in a separate incinerator at this facility to control TRS emissions. The cost and energy penalties for the separate incinerator are relatively large. The industry has commented that it may not be feasible to incinerate the waste gases from other sources in a kiln controlled by an ESP, because gases may explode in the ESP when flameouts occur in the kiln. Solutions to this potential problem, such as automatic diverting of inlet gases away from the kiln when a flameout occurs, have been considered, but there is at this time no demonstrated technology that will ensure that explosions would not occur.

In arriving at the proposed standard for particulate matter emissions from lime kilns, EPA considered the alternatives of a medium pressure drop scrubber alone, an ESP alone, and both particulate control systems operated in series. A separate incinerator to control TRS emissions from digester systems, multiple-effect evaporator systems, and condensate stripper systems was included in the two alternative ESP systems. EPA concluded that the relatively large increments in cost and energy usage associated with the ESP alternatives were not justified by the additional particulate control gained beyond that achievable with a medium pressure drop scrubber alone. Consequently, the proposed particulate matter standard would require a medium pressure drop scrubber (approximately 30 inches water gauge), or equivalent.

EPA has determined that an oxygen concentration in the gas stream measured after the lime kiln control device in excess of 10 percent represents excessive air inleakage; therefore, the proposed standards require that all measurements of particulate matter and TRS that have an oxygen concentration in excess of 10 percent be corrected to 10 percent oxygen.

SMELT DISSOLVING TANK

Smelt dissolving tanks discharge particulate matter comprised of finely divided smelt particles that are entrained in the steam emitted from the tank. On an uncontrolled basis, the quantity of particulate emissions is small in comparison with that from recovery furnaces and lime kilns. TRS emissions can be generated in the dissolving tank or in a scrubbing device that collects particulate matter, depending primarily on the sulfide content of water used to dissolve the smelt and to perform the scrubbing. Standards in terms of concentration of pollutants are not considered appropriate for smelt dissolving tanks because the effluent stream is primarily air and no correction for oxygen content and dilution air is possible to ensure effective enforcement.

Particulate emissions from smelt dissolving tanks are controlled by using wire mesh demister pads or low energy scrubbers. The scrubbers remove particulate matter much more effectively, though the energy requirements and operating costs are higher than for demisters. The proposed particulate standard for smelt dissolving tanks would require the use of low energy scrubbers, or equivalent systems, and is supported by four EPA tests on two types of low energy scrubbers. The proposed TRS standard for smelt dissolving tanks would prevent the use of water highly contaminated with sulfides for dissolving the smelt and for particulate scrubbing systems.

OTHER SOURCES

Approximately one-quarter of the total uncontrolled TRS emissions from a typical kraft pulp mill are generated by the digester system, brown stock washer system, black liquor oxidation system, multiple-effect evaporator system, and condensate stripper system. Ineffective control of these facilities could have a large impact on localized odor problems. The effluent streams can be incinerated in the recovery furnace, the lime kiln, or a separate incinerator to oxidise most of the TRS. The quantity of auxiliary fuel required for incineration is greatly reduced if incineration is performed in the recovery furnace and the lime kiln. If the noncondensable gases from the brown stock washer system and the black liquor oxidation system are incinerated, for example, in the recovery furnace, some auxiliary fuel may be required. However, the noncondensable gases from the digester system, multiple-effect evaporator system, and condensate stripper system would not require additional fuel if incinerated in the lime kiln as part of the primary air feed to the kiln. The proposed standard of 5 ppm TRS, four-hour average, for each of these five affected facilities would require incineration in the recovery furnace and the lime kiln, or equivalent.

OPACITY STANDARD

An opacity standard is proposed for recovery furnace systems to ensure proper operation and maintenance of the partciulate control device. No opacity standards are proposed for lime kilns and smelt dissolving tanks, which frequently generate persistent plumes of condensed water vapor. The effluent plume is so greatly dispersed by the time the vapor plume disappears that the observed opacity would not be as effective an indicator of the performance of the patriculate control system as other parameters. Monitoring the operating parameters of the control system would be more effective.

STATE IMPLEMENTATION PLANS

It should be noted that standards of performance for new sources established under section 111 of the Clean Air Act reflect emission limits achievable with the best adequately demonstrated systems of emission reduction considering the cost of such systems. State implementation plans (SIP's) approved or promulgated under section 110 of the Act, on the other hand, must provide for the attainment and maintenance of national ambient air quality standards (NAAQS) designed to protect public health and welfare. For that purpose SIP's must in some cases require greater emission reductions than those required by standards of performance for new sources. In addition, States are free under section 116 of the Act to establish more stringent emission limits than those established under section 111 or those necessary to attain or maintain the NAAQS under section 110. Thus, new and existing sources may in some cases be subject to limitations more stringent than EPA's standards of performance under section 111.

TESTING, MONITORING, AND RECORDKEEPING

Under the proposed standards, performance tests for TRS emissions according to Reference Method 16 proposed herein would be required for all affected facilities. Performance tests for particulate matter emissions from recovery furnace systems, lime kilns, and smelt dissolving tanks would also be required. Particulate matter emissions would be measured by Reference Methods 1 through 5. Method 17 (in-stack filter) is being proposed as an alternative method to measure particulate emissions from the recovery furnace. It is being proposed in Appendix A, Reference Methods, because the Agency intends to also propose Method 17 as a reference method to measure particulate matter from grain elevators.

The proposed standards include provisions for continuously monitoring the opacity of visible emissions discharged from recovery furnaces. To ensure proper operation and maintenance of scrubbers installed on lime kilns and on smelt dissolving tanks, provisions are included for monitoring the pressure drop across the scrubber and the scrubbing fluid supply pressure to the scrubber.

Where emissions from the digester system, brown stock washer system, multiple-effect evaporator system, black liquor oxidation system, or condensate stripper are incinerated in a device other than a lime kiln or recovery furnace, it is proposed that the firebox temperature of the device be monitored.

A requirement for the continuous monitoring of TRS emissions from the recovery furnace and lime kiln is also proposed. The specifications for continuous TRS monitors are not being proposed at this time because they have not been completely developed. However, the development of these specifications are imminent and they are expected to be promulgated at the time that the kraft pulp mill standards of performance are promulgated.

A requirement to monitor the oxygen concentration of the gas stream on a dry basis after the control device is being proposed for the lime kiln and recovery furnace. The montoring of oxygen concentrations is necessary to correct the TRC and particulate concentrations for the lime kiln and recovery furnace when the oxygen concentrations in the respective gas streams are in excess of 10 percent and 8 percent oxygen.

Records of performance testing measurements, continuous monitoring system measurements, and monitoring device measurement would have to be retained for at least two years following the date of the measurements by owners or operators subject to the provisions of this subpart. This requirement is included under § 60.7(d) of the regulation.

PUBLIC PARTICIPATION

As prescribed by section 111, this proposal of standards of performance has been preceded by the Administrator's determination that kraft pulp mills contribute significantly to air pollution which causes or contributes to the endangerment of public health or welfare and by his publication of this determination in this issue of the FEDERAL REGISTER. In accordance with section 117 of the Act, publication of these proposed standards was preceded by consultation with appropriate advisory committees, independent experts, and Federal departments and agencies.

Interested persons may participate in this rulemaking by submitting written comments (in triplicate) to the Emission Standards and Engineering Division, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711, Attention: Mr. Don R. Goodwin. The Administrator will welcome comments on all aspects of the proposed regulations, including the designation of kraft pulp mills as a significant contributor to air pollution which causes or contributes to the endangerment of public health or welfare, economic and technological issues, and the proposed test methods. All relevant comments received on or before November 22, 1976 will be considered. Comments received will be available for public inspection and copying at the EPA Public Information Reference Unit, Room 2922 (EPA Library), 401 M Street, S.W., Washington, D.C. 20460.

Background information on these proposed standards of performance has been published in a document entitled "Standards Support and Environmental Impact Statement: Standards of Performance for Kraft Pulp Mills, Volume 1." This report presents the factors considered in the development of the proposed standards, including alternative emission control systems, emission test data, environmental impact, costs, and economic considerations. Copies of the document may be obtained free of charge by writing to the Public Information Center (PM-215), U.S. Environmental Protection Agency, Washington, D.C. 20460 (specify "Standards Support and Environmental Impact Statement: Standards of Performance for Kraft Pulp Mills, Volume 1").

AUTHORITY: This notice of proposed rulemaking is issued under the authority of secs. 111, 114, and 301(a) of the Clean Air Act, as amended (42 U.S.C. 1857c-6, 1857c-9, 1857g(a)).

Dated: September 16, 1976.

JOHN QUARLES,
Acting Administrator.

It is proposed to amend Part 60 of Chapter I of Title 40 of the Code of Federal Regulations as follows:

1. By adding subpart BB as follows:

Subpart BB—Standards of Performance for Kraft Pulp Mills

Sec.
60.280 Applicability and designation of affected facility.
60.281 Definitions.
60.282 Standard for particulate matter.
60.283 Standard for total reduced sulfur (TRS).
60.284 Monitoring of emissions and operations.
60.285 Test methods and procedures.

AUTHORITY: Secs. 111, 114, and 301(a) of the Clean Air Act, as amended by sec. 4(a) of Pub. L. 91-604, 84 Stat. 1678 and by sec. 15 (c)(2) of Pub. L. 91-604, 84 Stat. 1713 (42 U.S.C. 1857c-6, 1857c-9, and 1857g(a)).

Subpart BB—Standards of Performance for Kraft Pulp Mills

§ 60.280 Applicability and designation of affected facility.

The provisions of this subpart are applicable to the following affected facilities in kraft pulp mills: digester system, brown stock washer system, multiple-effect evaporator system, black liquor oxidation system, recovery furnace, smelt dissolving tank, lime kiln, and condensate stripper system. In pulp mills in which kraft pulping is combined with neutral sulfide semichemical pulping, the provisions of this subpart are applicable when any portion of the material charged to an affected facility is produced by the kraft pulping operation.

§ 60.281 Definitions.

As used in this subpart, all terms not defined herein shall have the same meaning given them in the Act and in Subpart A.

(a) "Kraft pulp mill" means any stationary source which produces pulp from wood by cooking (digesting) wood chips in a water solution of sodium hydroxide and sodium sulfide (white liquor) at high temperature and pressure. Regeneration of the cooking chemicals through a recovery process is also considered part of the kraft pulp mill.

(b) "Neutral sulfite semichemical pulping operation" means any operation in which pulp is produced from wood by cooking (digesting) wood chips in a solution of sodium sulfite and sodium bicarbonate, followed by mechanical defibrating (grinding).

(c) "Total reduced sulfur (TRS)" means the sum of the sulfur compounds, primarily hydrogen sulfide, methyl mercaptan, dimethyl sulfide, and dimethyl disulfide, that are released during the kraft pulping operation and measured by Method 16.

(d) "Digester system" means each continuous digester or each batch digester used for the cooking of wood in white liquor, and associated flash tank(s), blow tank(s), chip steamer(s), and condenser(s).

(e) "Brown stock washer system" means knotters, vacuum pumps, and filtrate tanks used to wash the pulp following the digester system.

(f) "Multiple-effect evaporator system" means the multiple-effect evaporators and associated condenser(s) and hotwell(s) used to concentrate the spent cooking liquid that is separated from the pulp (black liquor).

(g) "Black liquor oxidation system" means the vessels used to oxidize, with air or oxygen, the black liquor, and associated storage tank(s).

(h) "Recovery furnace" means the unit used for burning black liquor to recover chemicals consisting primarily of sodium carbonate and sodium sulfide. The recovery furnance includes the direct-contact evaporator for a conventional furnace.

(i) "Smelt dissolving tank" means a vessel used for dissolving the smelt collected from the recovery furnace.

(j) "Lime kiln" means a unit used to calcine lime mud, which consists primarily of calcium carbonate, into quicklime, which is calcium oxide.

(k) "Condensate stripper system" means a column, and associated condensers, used to strip, with air or steam, TRS compounds from condensate streams from various processes within a kraft pulp mill.

§ 60.282 Standard for particulate matter.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere:

(1) From any recovery furnace any gases which:

(i) Contain particulate matter in excess of 0.10 g/dscm (0.044 gr/dscf).

(ii) Exhibit 35 percent opacity or greater.

(2) From any smelt dissolving tank any gases which contain particulate matter in excess of 0.15 g/Kg ADP (0.3 lb/ton ADP).

(3) From any lime kiln any gases which:

(i) Contain particulate matter in excess of 0.15 g/dscm (0.067 gr/dscf) when gaseous fossil fuel is burned.

(ii) Contain particulate matter in excess of 0.30 g/dscm (0.13 gr/dscf) when liquid fossil fuel is burned.

§ 60.283 Standard for total reduced sulfur (TRS).

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere:

(1) From any digester system, brown stock washer system, multiple-effect evaporator system, black liquor oxidation system, or condensate stripper system any gases which contain TRS in excess of 5 parts per million (ppm) by volume, except as provided under paragraph (b) of this section.

(2) From any recovery furnace any gases which contain TRS in excess of 5 ppm by volume.

(3) From any smelt dissolving tank any gases which contain TRS in excess of 0.025 g/Kg ADP (0.0125 lb/ton ADP).

(4) From any lime kiln any gases which contain TRS in excess of 5 ppm by volume.

(b) The Administrator may exempt any new, modified, or reconstructed black liquor oxidation system or brown stock washer system at an existing kraft pulp mill provided the owner or operator demonstrates that incinerating the exhaust gases from such system in an existing recovery furnace is technologically and economically not feasible. Any exempt system will become subject to the provisions of this subpart if the recovery furnace is changed so that the gases can be incinerated.

§ 60.284 Monitoring of emissions and operations.

(a) Any owner or operator subject to the provisions of this subpart shall install, calibrate, maintain, and operate the following continuous monitoring systems:

(1) A continuous monitoring system to monitor and record the opacity of the gases discharged into the atmosphere from any recovery furnace. The span of this system shall be set at 50 percent opacity.

(2) A continuous monitoring system, except as provided in paragraph (b) (1) of this section, to monitor and record the concentration of TRS emissions discharged into the atmosphere from any digester system, brown stock washer system, multiple-effect evaporator system, black liquor oxidation system, recovery furnace, lime kiln, or condensate stripper system. The span shall be set at a TRS concentration of 30 ppm.

(3) A continuous monitoring system to monitor and record the percent of oxygen by volume in the gases discharged from any recovery furnace or lime kiln. The continuous monitoring system shall be located downstream of the control device(s) for the recovery furnace or lime kiln, and all measurements shall be made on a dry basis. The span of this system shall be set at 20 percent oxygen.

(b) Any owner or operator subject to the provisions of this subpart shall install, calibrate, maintain, and operate the following continuous monitoring devices:

(1) A monitoring device which measures the combustion temperature at the point of incineration of effluent gases which are emitted from any digester system, brown stock washer system, multiple-effect evaporator system, black liquor oxidation system, or condensate stripper system and which are combusted in a power boiler or separate incineration unit. The monitoring device is to be certified by the manufacturer to be accurate within ±2° C (±3.6° F).

(2) For any lime kiln or smelt dissolving tank using a scrubber emission control device:

(i) A monitoring device for the continuous measurement of the pressure loss of the gas stream through the control equipment. The monitoring device is to be certified by the manufacturer to be accurate to within a gage pressure of ±250 pascals (ca. ±1 inch water gage pressure).

(ii) A monitoring device for the continuous measurement of the scrubbing liquid supply pressure to the control equipment. The monitoring device is to be certified by the manufacturer to be accurate within ±5 percent of design scrubbing liquid supply pressure. The pressure sensor or tap is to be located close to the scrubber liquid discharge point. The Administrator may be consulted for approval of alternative locations.

(c) Any owner of operator subject to the provisions of this subpart shall calculate and record on a daily basis:

(1) Four-hour average TRS concentrations for the six consecutive four-hour periods of each operating day. Each four-hour average shall be determined as the arithmetic mean of the appropriate four contiguous one-hour average total reduced sulfur concentrations provided by each continuous monitoring system installed under paragraph (a) (2) of this section.

(2) Four-hour average oxygen concentrations for the six consecutive four-hour periods of each operating day for the recovery furnace and lime kiln. These four-hour averages shall correspond to the four-hour average TRS concentrations under paragraph (c) (1) of this section and shall be determined as an arithmetic mean of the appropriate four contiguous one-hour average oxygen concentrations provided by each continuous monitoring system installed under paragraph (a) (3) of this section.

(d) Any owner or operator of a recovery furnace or lime kiln subject to the provisions of this subpart shall:

(1) Correct any four-hour average TRS concentration corresponding to a four-hour average oxygen concentration that is in excess of 8 volume percent for the recovery furnace. The concentration shall be corrected to 8 volume percent oxygen.

(2) Correct any four-hour average TRS concentration corresponding to a four-hour average oxygen concentration that is in excess of 10 volume percent for the lime kiln. The concentration shall be corrected to 10 volume percent oxygen.

(3) Calculate the corrections required in paragraphs (d) (1) and (2) of this section according to the following equation:

$$C_{corr} = C_{meas} \times \left(\frac{21-X}{21-Y}\right)$$

where:

C_{corr} = the four-hour TRS concentration corrected for oxygen.

C_{meas} = the four-hour average measured TRS concentration uncorrected for oxygen.

X = the volumetric oxygen concentration in percentage to be corrected to (8 percent for the recovery furnace and 10 percent for the lime kiln).

Y = the measured four-hour average volumetric oxygen concentration above 8 volume percent for the recovery furnance and above 10 volume percent for the lime kiln.

(e) For the purpose of reports required under § 60.7(c), any owner or operator subject to the provisions of this subpart shall report periods of excess emissions as follows:

(1) For emissions from the recovery furnace:

(i) All four-hour averages of TRS concentrations above 5 ppm.

(ii) All six-minute average opacities that exceed 35 percent, except that 5 percent of the averages may exceed 35 percent opacity. The exception does not apply to excess emissions due to malfunctions, startups, or shutdowns of the facility or control device.

(2) For emissions from the lime kiln: All four-hour average TRS concentrations above 5 ppm, except that 6 percent of all four-hour averages of TRS concentrations are not considered to be excess emissions if they are less than 10 ppm. The exception does not apply to excess emissions due to malfunctions, startups, or shutdowns of the facility or control device.

(3) For emissions from the digester system, brown stock washer system, multiple-effect evaporator system, black liquor oxidation system, or condensate stripper system where the gases are incinerated in a device other than a recovery furnace or lime kiln: All four-hour average TRS concentrations above 5 ppm, unless the requirements of paragraph (b) (1) of this section are met.

§ 60.285 Test methods and procedures.

(a) Reference methods in Appendix A of this part, except as provided under § 60.8(b), shall be used to determine compliance with § 60.282(a) as follows:

(1) Method 5 for the concentration of particulate matter and the associated moisture content,

(2) Method 1 for sample and velocity traverses,

(3) When determining compliance with § 60.282(a) (2), Method 2 for velocity and volumetric flow rate,

(4) Method 3 for gas analysis, and

(5) Method 9 for visible emissions.

(b) For Method 5, the sampling time for each run shall be at least 60 minutes and the sampling rate shall be at least 0.85 dscm/hr (0.53 dscf/min) except that shorter sampling times, when necessitated by process variables or other factors, may be approved by the Administrator. Water shall be used as the cleanup solvent instead of acetone in the sample recovery procedure outlined in Method 5.

(c) Method 17 (in-stack filtration) may be used as an alternate method for Method 5 for determining compliance with § 60.282(a)(1)(i): *Provided*, That a constant value of 0.009 g/dscm (0.004 gr/dscf) is added to the results of Method 17 and the stack temperature is no greater than 205° C (ca. 400° F). Water shall be used as the cleanup solvent instead of acetone in the sample recovery procedure outlined in Method 17.

(d) For the purpose of determining compliance with § 60.283(a) (1), (2), (3), and (4), the following reference methods shall be used:

(1) Method 16 for the concentration of TRS.

(2) Method 3 for gas analysis, and

(3) When determining compliance with § 60.283(a)(3), Method 2 for velocity and volumetric flow rate.

(e) All concentrations of particulate matter and TRS from the lime kiln and recovery furnace that are measured as required by this section shall be corrected to 10 volume percent oxygen and 8 volume percent oxygen, respectively, when the oxygen concentrations exceed these values.

APPENDIX A—REFERENCE METHODS

2. Method 16 and Method 17 are added to Appendix A as follows:

* * * * *

METHOD 16—SEMICONTINUOUS DETERMINATION OF SULFUR EMISSIONS FROM STATIONARY SOURCES

1. *Principle and applicability*

1.1 *Principle*. A gas sample is extracted from the emission source and diluted with clean dry air. An aliquot of the diluted sample is then analyzed for gaseous sulfur compounds by gas chromatographic (GC) separation and flame photometric (FPD) detection. Two GC/FPD analytical systems equipped with suitable columns are used for resolution of both low and high molecular weight TRS compounds.

1.2 *Applicability*. This method is applicable for determination of TRS compounds when specified by an applicable subpart.

2. *Range and sensitivity*

2.1 *Range*. The maximum limit of the FPD for each sulfur compound is about 1 ppm. This limit is expanded by dilution of the sample gas before analysis. Kraft mill gas samples are normally diluted tenfold (10:1), resulting in an upper limit of about 10 ppm for each compound.

2.2 *Sensitivity*. The minimum detectable concentration of the FPD is less than 50 ppb.

3. *Interferences*

3.1 *Moisture condensation*. Moisture condensation in the sample delivery system, the analytical column, or the FPD burner block can cause losses or interferences. This potential is eliminated by heating the sample line, and by conditioning the sample with dry dilution air to lower its dew point below the operating temperature of the GC/FPD analytical system prior to analysis.

3.2 *Carbon monoxide and carbon dioxide*. CO and CO_2 have a substantial desensitizing effect on the detector even after 10:1 dilution. This potential interference is eliminated by eluting CO and CO_2 with the "air peak" prior to elution of any sulfur compound.

3.3 *Particulate matter*. Particulate matter in gas samples can cause interference by eventual clogging of the analytical system. This interference is eliminated by use of a filtered probe described in Section 5.1.1.

4. *Precision*

4.1 *Calibration precision*. A series of three consecutive injections of the same calibration gas, at any dilution, should produce results which do not vary by more than ±3% from the mean of the three injections.

4.2 *Calibration drift*. The calibration drift determined from the mean of three injections made at the beginning and end of any 8-hour period should not exceed ±3%.

5. *Apparatus*

5.1.1 *Probe*. Figure 16-1 illustrates the probe used in lime kilns and other sources where significant amounts of particulate matter are present. The probe is designed with the deflector shield placed between the sample and the gas inlet holes and the glass wool plugs to reduce clogging of the filter and possible adsorption of sample gas. The exposed portion of the probe between the sampling port and the sample line is heated with heating tape.

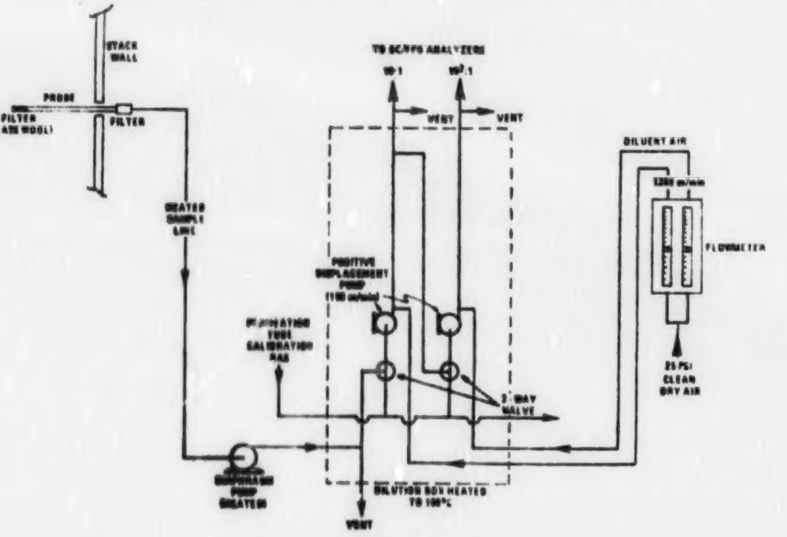

Figure 16-2. Sampling and dilution apparatus

5.1.2 Sample line—$\frac{3}{16}$ inch inside diameter Dekoron FEP Teflon[1] tubing, heated to 120° C. This temperature is controlled by a thermostatic heater.

5.1.3 Sample pump—Leakless Teflon coated diaphragm type or equivalent. The pump head is heated to 120° C by enclosing it in the sample dilution box (5.2.4 below).

5.2 Dilution system—A schematic diagram of the dynamic dilution system is given in Figure 16-2. The dilution system is constructed such that all sample contacts are made of inert materials. The dilution system which is heated to 120° C, must be capable of a minimum of 10:1 dilution of sample. Equipment used in the dilution system is listed below:

5.2.1 Dilution pump—Model A-150 Komhyr Teflon positive displacement type, non-adjustable 150 cc/min. ±2.0%, or equivalent, per dilution stage. A 10:1 dilution of sample is accomplished by combining 150 cc of sample with 1350 cc of clean dry air as shown in Figure 16-2.

5.2.2 Valves—Three-way Teflon solenoid or manual type.

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[1] Mention of trade names or specific products does not constitute an endorsement by the Environmental Protection Agency.

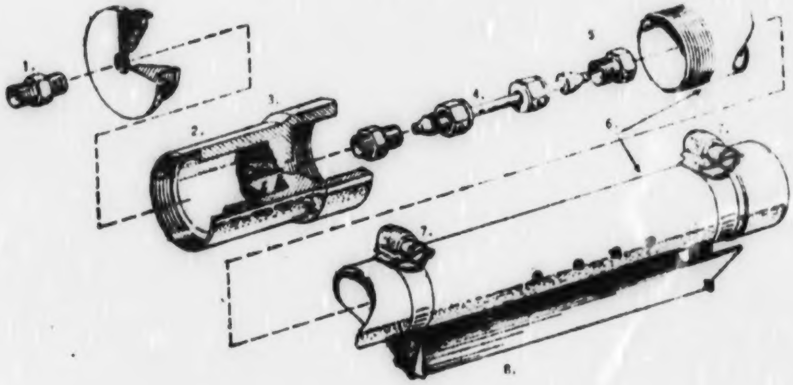

Figure 16-1. Probe used for gas containing high particulate loadings.

DESCRIPTION OF FIGURE 16-1

1. ¼" male connector ⅛" pipe size.

2. A Gelman[1] filter—this filter has glass wool inside.

3. 1" pipe cap which is drilled out and welded on the end of the Gelman filter.

4. ¼" stainless steel tubing with four 1/16" holes drilled all the way through both sides. These holes are ¼" apart. The tubing is also packed with glass wool inside.

5. ¼" cap for capping end of tubing.

6. 1" stainless steel pipe thread at both ends, four ⅛" holes or drilled all the way through both sides. These holes are 1" apart.

7. 1½" clamps.

8. A V-type deflector.

9. 1" pipe cap.

5.2.3 Tubing—Teflon tubing and fittings are used throughout from the sample probe to the GC/FPD to present an inert surface for sample gas.

5.2.4 Box—Insulated box, heated and maintained at 120° C, of sufficient dimensions to house dilution apparatus.

5.2.5 Flowmeters—Rotameters or equivalent to measure flow from 0 to 1500 ml/min ±1% per dilution stage.

5.3 Gas Chromatograph Columns—Two types of columns are used for separation of low and high molcular weight sulfur compounds:

5.3.1 Low Molecular Weight Sulfur Compounds Column (GC/FPD-1).

5.3.1.1 Separation Column—11 m by 2.16 mm (36 ft by 0.085 in) inside diameter Teflon tubing packed with 30/60 mesh Teflon coated with 5% polyphenyl ether and 0.05% orthophosphoric acid, or equivalent (see Figure 16-3).

5.3.1.2 Stripper or Precolumn—0.6 m by 2.16 mm (2 ft by 0.085 in) inside diameter Teflon tubing packed as in 5.3.1.

5.3.1.3 Sample Valve—Teflon ten-port gas sampling valve, equipped with a 10 ml sample loop, actuated by compressed air (Figure 16-3).

5.3.1.4 Oven—For containing sample valve, stripper column and separation column. The oven should be capable of maintaining an elevated temperature ranging from ambient to 100° C, constant within ±1° C.

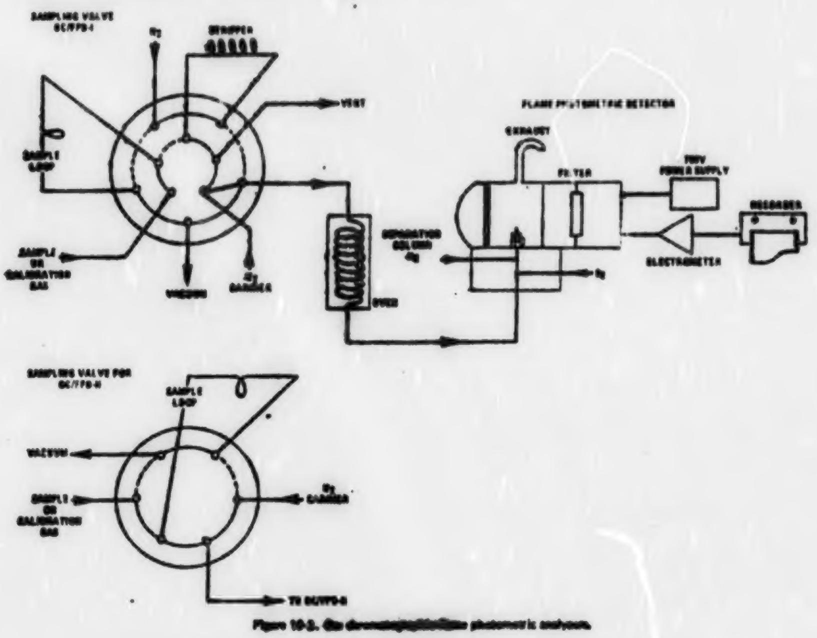
SAMPLING VALVE GC/FPD-I
N2
STRIPPER
VENT
SAMPLE LOOP
SAMPLE OR CALIBRATION GAS
VACUUM
N2 CARRIER
SEPARATION COLUMN
OVEN
FLAME PHOTOMETRIC DETECTOR
EXHAUST
FILTER
POWER SUPPLY
RECORDER
ELECTROMETER
SAMPLING VALVE FOR GC/FPD-II
SAMPLE LOOP
VACUUM
SAMPLE OR CALIBRATION GAS
N2 CARRIER
TO GC/FPD-II

Figure 16-2. Gas chromatograph/flame photometric analyzers.

5.3.1.5 Temperature Monitor—Thermocouple pyrometer to measure column oven, detector, and exhaust temperature ±1° C.

5.3.1.6 Flow System—Gas metering system to measure sample flow, hydrogen flow, oxygen flow and nitrogen carrier gas flow.

5.3.1.7 Detector—Flame photometric detector.

5.3.1.8 . Electrometer—Capable of full scale amplification of linear ranges of 10^{-9} to 10^{-4} amperes full scale.

5.3.1.9 Power Supply—Capable of delivering up to 750 volts.

5.3.1.10 Recorder—Compatible with the output voltage range of the electrometer.

5.3.2 High Molecular Weight Compounds Column (GC/FPD-II).

5.3.2.1 Separation Column—3.05 m by 2.16 mm (10 ft by 0.085 in.) inside diameter Teflon tubing packed with 30/60 mesh Teflon coated with 10 percent Triton X-305, or equivalent.

5.3.2.2 Sample Valve—Teflon six-port gas sampling valve equipped with a 10 ml sample loop, actuated by compressed air (Figure 16-3).

5.3.2.3 Other Components—All components same as in 5.3.1.4 to 5.3.1.10.

5.4 Calibration—Permeation tube system (Figure 16-4).

5.4.1 Tube Chamber—Glass chamber of sufficient dimensions to house permeation tubes.

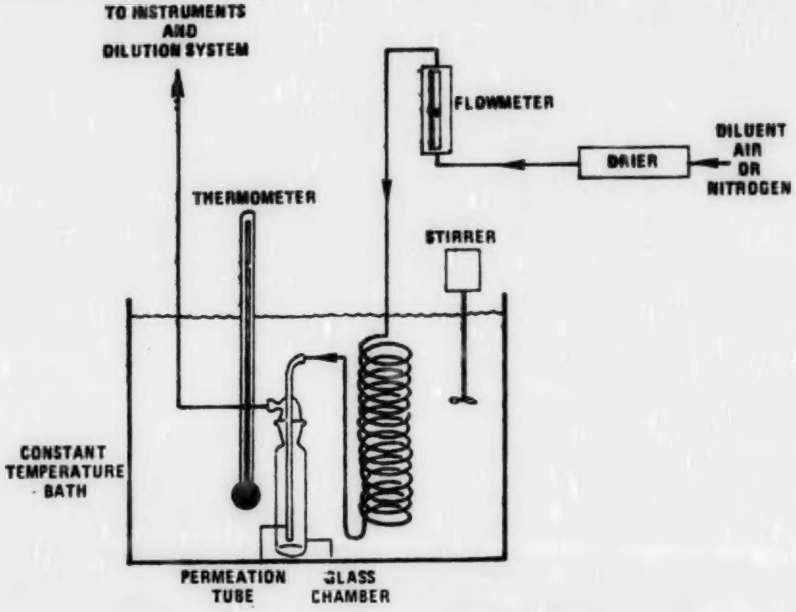

Figure 16-4. Apparatus for field calibration.

5.4.2 Mass Flowmeters—Two mass flowmeters in the range 0-3 l/min. and 0-10 l/min. to measure air flow over permeation tubes at ±2%. These flowmeters shall be cross-calibrated at the beginning of each test. Using a convenient flow rate in the measuring range of both flowmeters, set and monitor the flow rate of gas over the permeation tubes. Injection of calibration gas generated at this flow rate as measured by one flowmeter followed by injection of calibration gas at the same flow rate as measured by the other flowmeter should agree within the specified precision limits. If they do not, then there is a problem with the mass flow measurement. Each mass flowmeter shall be calibrated prior to the first test with a wet test meter and thereafter, at least once each year.

5.4.3 Constant Temperature Bath—Capable of maintaining permeation tubes at certification temperature of 30° C within ±0.1/ C.

5.4.4 Temperature Monitor—Thermometer or equivalent to monitor bath temperature within ±0.1° C.

6. Reagents

6.1 Fuel. Hydrogen (H_2) prepurified grade or better.

6.2 Combustion Gas. Oxygen (O_2) research purity or better.

6.3 Carrier gas. Nitrogen (N_2) prepurified grade or better.

6.4 Diluent. Air containing less than 0.5 ppb total sulfur compounds and less than 10 ppm each of moisture and total hydrocarbons, and filtered using MSA filters 46727 and 79030, or equivalent. Removal of sulfur compounds can be verified by injecting dilution air only described in Section 8.4.

6.5 Compressed Air. 60 psig for GC valve actuation.

6.6 Calibration Gases. Permeation tubes gravimetrically calibrated and certified at 30.0° C.

7. Pre-test Procedures

7.1 After the complete measurement system has been set up at the site and verified to be operational, the following procedures shall be completed before sampling is initiated.

7.1.1 Flowmeter Calibration and Leak Test—Appropriate calibration and leak test procedures shall be employed to verify the accuracy and/or integrity of all flowmeters, sample lines, and connections. For components under negative pressure (lines and connections upstream of the sample pump) a leak test is performed using the sample pump to pull a vacuum. Attach the probe end of the sample line to a manometer or vacuum gauge, start the pump and pull greater than 50 mm (2 in.) Hg vacuum. Close off the pump outlet, then stop the pump and ascertain that there is no leak for 5 minutes. For components subject to positive pressure, leak tests shall be performed at each joint by applying a liquid (detergent in water, for example) which will foam in the presence of a leak.

Since the complete dilution system and GC/FPD is calibrated prior to and following each test, the precise calibration of each component is not critical. However, these components should be verified to be operating properly. This verification can be performed by observing the response of flowmeters or of the GC output to changes in flow rates or calibration gas concentrations and ascertaining the response to be within predicted limits. If any component, or if the complete system fails to respond in a normal and predictable manner, the source of the discrepancy shall be identified and corrected before proceeding.

7.1.2 Mass Flowmeter Calibration—Since all sample calculations are based on the accuracy of air flow measured by the mass flowmeters, it is essential that the cross-calibration check of Section 5.4.2 be followed.

7.1.3 Prior to any sampling run, calibrate the system using the procedures set forth in Section 8. If more than one run is performed during any 24-hour period, a calibration need not be performed prior to the second and any subsequent runs. The calibration must, however, be verified as prescribed in Section 8, after the last run made within the 24-hour period.

8. Calibration

8.1 General considerations. This section outlines steps to be followed for use of the GC/FPD and the dilution system. The procedure does not include detailed instructions because operation of these systems is complex, and it requires an understanding of the individual system being used. Each system should include a written operating manual describing in detail the operating procedures associated with each component in the measurement system. In addition, the operator should be familiar with the operating principles of the components; particularly the GC/FPD. The references cited at the end of this method are recommended for review for this purpose.

8.2 Permeation Tubes. Under the following procedure, accurately known concentrations (±1%) of a variety of sulfur compounds are generated by passing clean dry air or other diluent gas over permeation tubes, each containing a specific sulfur compound as a permeant. These tubes consist of hermetically sealed FEP Teflon tubing in which a liquefied gaseous substance is enclosed. The enclosed gas permeates through the tubing wall at a constant rate. When the temperature is constant, calibration gases covering a wide range of known concentrations can be generated by varying and accurately measuring the flow rate of diluent gas passing over the tubes. These calibration gases are used to calibrate the GC/FPD system and the dilution system.

8.3 Calibration Procedure. Assemble the permeation tube calibration apparatus as depicted in Figure 16-4. Insert the permeation tubes into the glass tube chamber. Check the bath temperature to assure agreement with the calibration temperature of the tubes within ±0.1° C. A temperature of 30° C is recommended for the sulfur gas tubes. Allow twenty-four hours for the tubes to equilibrate. When equilibrated, vary the flow rate of diluent air flowing over the tubes to produce the desired concentrations for calibrating the analytical and dilution systems. The air flow across the tubes must at all times exceed the flow requirement of the analytical systems. The concentration in parts per million generated by a tube containing a specific permeant can be calculated as follows:

$$C = K\frac{P_r}{ML}$$

Equation 16-1

where:

C=Concentration of permeant produced in ppm.
P_r=Permeation rate of the tube in µg/min.
M=Molecular weight of the permeant $\left(\frac{g}{g\text{-mole}}\right)$.
L=Flow rate, l/min, of air over permeant @20°C, 760 mm Hg.
K=Gas constant at 20°C and 760 mm Hg=24.04 l/g mole

8.4 Operating Conditions for GC/FPD Systems.

8.4.1 Low-Molecular Weight Sulfur Compounds—The operating parameters for the GC/FPD system used for low molecular weight compounds are as follows: nitrogen carrier gas flow rate of 50 cc/minute, exhaust temperature of 110° C, detector temperature of 105° C, oven temperature of 40° C, hydrogen flow rate of 80 cc/minute, oxygen flow rate of 20 cc/minute, and sample flow rate between 20 and 80 cc/minute.

8.4.2 High-Molecular Weight Sulfur Compounds—The operating parameters for the GC/FPD system for high molecular weight compounds are the same as in 8.4.1. except: oven temperature of 70° C, and nitrogen carrier gas flow of 100 cc/minute.

8.5 Calibration of GC/FPD Analysis Systems. Generate a series of three or more known concentrations spanning the linear range of the FPD (approximately 0.05 to 1.0 ppm) for each sulfur compound anticipated to be present in the gas stream analysed. Bypassing the dilution system, inject these standards into the GC/FPD analysers and monitor the responses. Three injects for each concentration must yield the precision described in Section 4.1. Failure to attain this precision is an indication of a problem in the calibration or analytical system. Any such problem must be identified and corrected before proceeding. Peak heights, rather than integrated areas, have proven satisfactory; however, integrated areas may be required for alternate columns or instrumentation.

8.5. Calibration Curves—Plot the GC/FPD responses in current (amperes) versus their causative concentrations in ppm on log-log coordinate graph paper for each sulfur compound calibrated.

8.6 Calibration of Dilution System. Generate a known concentration of hydrogen sulfide using the permeation tube system. Adjust the flow rate of diluent air for the first dilution stage so that the desired level of dilution is approximated. Inject the diluted is approximated. Inject the diluted calibration gas into GC/FPD-I and monitor its response. Three injects for each dilution must yield the precision described in Section 4.1. Failure to attain this precision in this step is an indication of a problem in the dilution system. Any such problem must be identified and corrected before proceeding. Using the calibration curve for H_2S (developed under 8.4.1) determine the diluted calibration gas concentration in ppm. Then, calculate the dilution factor as the ratio of the calibration gas concentration before dilution to the diluted calibration gas concentration determined under this paragraph. Repeat this procedure for each stage of dilution required.

9. *Sampling and analysis procedure*

9. Sampling. Insert the sampling probe into the test port making certain that no dilution air enters the stack through the port. Begin sampling and dilute the sample approximately 10:1 using the dilution system shown in Figure 16-3. Note that the precise dilution factor is that which is determined in paragraph 8.5. Condition the entire system with sample for a minimum of 15 minutes prior to commencing analysis.

9.2 Analysis. Aliquots of diluted sample are injected simultaneously into both GC/FPD analysers for analysis. GC/FPD-I is used to measure the low-molecular weight reduced sulfur compounds. The low molecular weight compounds include hydrogen sulfide, sulfur dioxide, methyl mercaptan, ethyl mercaptan, and dimethyl sulfide. GC/FPD-II is used to resolve the high-molecular weight compounds. The high molecular weight compounds include propyl mercaptan, butyl mercaptan, dimethyl disulfide, dipropyl sulfide, and dibutyl sulfide.

9.2.1 Analysis of Low-Molecular Weight Sulfur Compounds—The sample valve is actuated for one to three minutes in which time an aliquot of diluted sample is injected into the stripper column and analytical column. The valve is then de-actuated for approximately fifteen minutes in which time, the analytical column continues to be foreflushed, the stripper column is backflushed, and the sample loop is refilled. Monitor the responses. The elution time for each compound will be determined during calibration.

9.2.2 Analysis of High-Molecular Weight Sulfur Compounds—The procedure is essentially the same as above except that no stripper column is needed.

9.2.3 Sample Run—A sample run is composed of 16 individual analyses (injects) performed over a period of not less than 3 hours or more than 6 hours.

9.2.4 Observation for Clogging of Probe—If reductions in sample concentrations are observed during a sample run that cannot be explained by process conditions, the sampling must be interrupted to determine if the sample probe is clogged with particulate matter. After each run, the sample probe must be inspected and, if necessary, dismantled and cleaned.

10. *Post-Test procedures*

10. Recalibration. After each run, or after a series of runs made within a 24-hour period, perform a partial recalibration using the procedures in Section 8. Only H_2S (or other permeant) need be used to recalibrate the GC/FPD analysis system (8.4) and the dilution system (8.5).

10. Determination of Calibration Drift. Compare the calibration curves obtained prior to the runs, to the calibration curves obtained under paragraph 10.1. The calibration drift must not exceed the limits set forth in paragraph 4.2. If the drift exceeds this limit, the intervening run or runs shall be considered not valid.

11. *Calculations*

11.1 Determine the concentrations of each reduced sulfur compound detected directly from the calibration curves.

11.2 Calculation of TRS. Total reduced sulfur will be determined for each analysis made by summing the concentrations of each reduced sulfur compound resolved during a given analysis.

$$\text{TRS} = \sum(H_2S,\ \text{MeSH},\ 2\text{DMS},\ x)d$$

Equation 16-2

where

TRS=Total reduced sulfur in ppm, wet basis.
H_2S=Hydrogen sulfide, ppm.
MeSH=Methyl mercaptan, ppm.
DMS=Dimethyl sulfide, ppm.
DMDS=Dimethyl disulfide, ppm.
x=Other reduced sulfur compounds.
d=Dilution factor, dimensionless.

11.3 Average TRS. The average TRS will be determined as follows:

$$\text{Avg. TRS} = \frac{\sum_{i=1}^{N} TRS_i}{N\,(1-B_{wo})}$$

Equation 16-3

where:

Avg. TRS=Average total reduced sulfur in ppm, dry basis.
TRS_i=Total reduced sulfur in ppm as determined by Equation 16-2.
N=Number of analyses performed.
B_{wo}=Fraction of volume of water vapor in the gas stream as determined by Method 4—Determination of Moisture in Stack Gases (36 FR 24887).

12. *Bibliography*.

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METHOD 17—DETERMINATION OF PARTICULATE EMISSIONS FROM STATIONARY SOURCES (IN-STACK FILTRATION METHOD)

Introduction. Particulate matter is not an absolute quantity; rather it is a variable which is a function of temperature and pressure. For this reason, particulate matter emission regulations and/or associated test methods must define or take cognizance of the temperature and pressure at which particulate matter is to be measured. If temperature is not defined, and if the effect of temperature upon the quantity of particulate in an effluent gas is unknown, then the particulate emission regulation may be variable. The range of pressure which exist from source to source is of negligible importance.

In Method 5, 250° F is established as a nominal reference temperature. Thus, where Method 5 is specified under an applicable subpart, particulate matter is defined with respect to temperature. In order to maintain this indicated temperature, Method 5 includes a heated glass sample probe and a heated filter holder. This equipment is cumbersome and requires care in its operation. Therefore, where particulate matter concentrations (over the normal range of temperature associated with a specified source category) are known to be independent of temperature, it is desirable to eliminate the glass probe and heating system, and sample at stack temperature.

This method describes an in-stack sampling system and sampling procedures for use where particulate matter concentrations are independent of temperature. It may be used to conduct performance tests under 40 CFR 60.8 within specified conditions, or when approved by the Administrator.

1. Principle and applicability

1.1 Principle. Particulate matter is withdrawn isokinetically from a gas stream and collected on a glass fiber filter maintained at stack temperature. The particulate matter mass is determined gravimetrically after removal of uncombined water.

1.2 Applicability. This method applies to the measurement of particulate matter emissions from stationary sources and is used to determine compliance with new source performance standards, when specifically provided for in an applicable subpart of the standards. This method is not applicable when stack gases are saturated with water vapor or when the projected cross-sectional are of the probe extension-filter holder assembly (when inserted halfway into the stack) covers more than 3% of the stack cross-sectional area (see Section 4.1.2).

2. Apparatus

2.1 Sampling train. A schematic of the sampling train used in this method is shown in Figure 17-1. Construction details for many, but not all, of the train components are given in APTD-0581; for changes from the APTD-0581 document and for allowable modifications to Figure 17-1, consult with the Administrator.

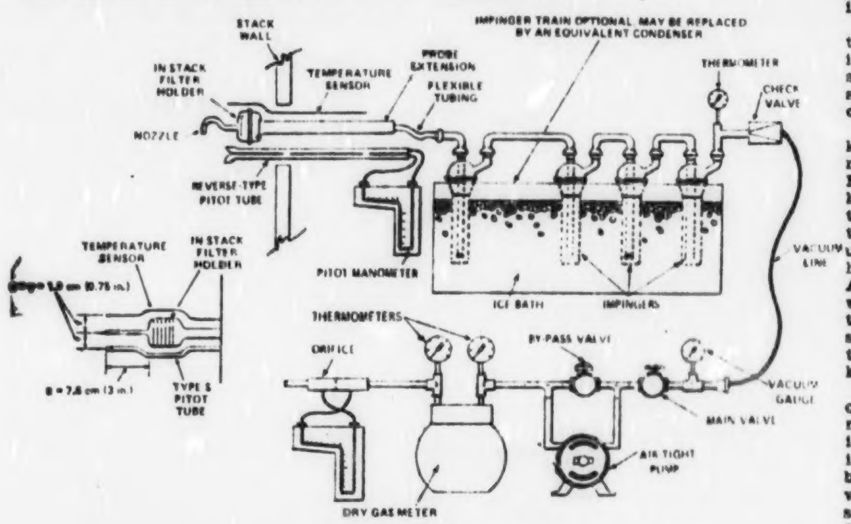

Figure 17-1. Particulate sampling train, equipped with in-stack filter.

The operating and maintenance procedures for many of the sampling train components are described in APTD-0576. Since correct usage is important in obtaining valid results, all users should read the APTD-0576 document and adopt the operating and maintenace procedures outlined in it, unless otherwise specified herein.

2.1.1 Probe nozzle—Stainless steel (316) with sharp, tapered leading edge. The angle of taper shall be ≤30° and the taper shall be on the outside to preserve a constant internal diameter. The probe nozzle shall be of the button-hook or elbow design, unless otherwise approved by the Administrator. The nozzle shall be constructed from seamless stainless steel tubing. Other configurations and construction material may be used subject to approval from the Administrator.

A range of sizes suitable for isokinetic sampling should be available, e.g., 0.32 cm (⅛ in.) up to 1.27 cm (½ in.) (or larger if higher volume sampling trains are used) inside diameter (ID) nozzles in increments of 0.16 cm (1/16 in.). Each nozzle shall be calibrated according to the procedures outlined in the calibration section.

2.1.2 Filter Holder. The in-stack filter holder shall be constructed of borosilicate or quartz glass or stainless steel; if a gasket is used, it shall be made of silicone rubber, teflon, or stainless steel. Other holder and gasket materials may be used with approval from the Administrator. The filter holder shall be designed to provide a positive seal against leakage from the outside or around the filter.

2.1.3 Probe Extension—Any suitable rigid probe extension may be used after the filter holder. Flexible tubing may also be used between the probe extension and the condenser.

2.1.4 Pitot tube—Type S, or other device approved by the Administrator, attached to probe extension to allow constant monitoring of the stack gas velocity. The face openings of the pitot tube and the probe nozzle shall be adjacent and parallel to each other, not necessarily in the same plane, during sampling. The free space between the nozzle and pitot tube (see Figure 17-1) shall be at least 1.9 cm (0.75 in.). The free space shall be set based on a 1.3 cm (0.5 in.) ID nozzle. If the sampling train is designed for sampling at higher flow rates than that described in APTD-0581, thus necessitating the use of larger sized nozzles, the largest sized nozzle shall be used to set the free space. In addition, to minimize aerodynamic interactions between the pitot tube and filter holder, there shall be a distance of at least 3 inches between the center line of the pitot tube impact openings and the leading edge of the filter holder (see Figure 17-1).

The pitot tube must meet the criteria specified in Method 2, and be calibrated separately (i.e., apart from its assembly configuration) according to the procedures outlined in that method for the calibration of isolated Type S pitot tubes.

2.1.5 Differential pressure gauge—Inclined manometer capable of measuring velocity head within 10% of the minimum measured value or ±0.013 mm (0.0005 in.), whichever is greater. Below a differential pressure of 1.3 mm (0.05 in.) water gauge, micromanometers with sensitivities of 0.013 mm (0.0005 in.) should be used. However, micromanometers are not easily adaptable to field conditions and are not easy to use with pulsating flow. Thus, methods or other devices acceptable to the Administrator may be used when conditions warrant.

2.1.6 Condenser—Any system that cools the sample gas stream (e.g., impingers connected in series, as in Method 5) and allows measurement of both the water condensed and the moisture leaving the condenser, each to within 1 ml or 1 g. The moisture leaving the condenser can be measured either by: (1) monitoring the temperature and pressure at the exit of the condenser and using Dalton's law; or (2) passing the sample gas stream through a silica gel trap with exit gases kept below 20° C (68° F) and determining the weight gain.

If means other than silica gel are used to determine the amount of moisture leaving the condenser, it is recommended that silica gel still be used between the condenser system and pump to prevent moisture condensation in the pump and metering devices.

2.1.7 Metering system—Vacuum gauge, leak-free pump, thermometers capable of measuring temperature to within 3° C (5.4° F), dry gas meter with 2% accuracy, and related equipment, or equivalent, as required to maintain an isokinetic sampling rate and to determine sample volume. Sampling trains utilizing metering systems designed for higher flow rates than that described in APTD-0581 or APTD-0576 may be used provided that the specifications in section 2 of this method are met. When the metering system is used in conjunction with a pitot tube, the system shall enable checks of isokinetic rates.

2.1.8 Barometer—Mercury, aneroid, or other barometers capable of measuring atmospheric pressure to within 2.5 mm Hg (0.1 in. Hg). In many cases, the barometric reading may be obtained from a nearby weather bureau station, in which case the station value (which is the absolute barometric pressure) shall be requested and an adjustment for elevation differences between the weather station and sampling point shall be applied at a rate of minus 2.5 mm Hg (0.1 in. Hg) per 30 m (100 ft) elevation increase or vice versa for elevation decrease.

2.1.9 Gas density determination equipment—Temperature and pressure gauges and gas analyzer as described in Methods 2 and 3.

2.1.10 Temperature and pressure gauges—If Dalton's law is used, to monitor temperature and pressure at condenser outlet. The temperature gauge shall have an accuracy of 1° C (2° F). The pressure gauge shall be capable of measuring pressure to within 2.5 mm. Hg (0.1 in. Hg). If silica gel is used in the condenser system the temperature and pressure must be measured before the silica gel component.

2.2 Sample recovery.

2.2.1 Probe nozzle brush—Nylon bristles with stainless steel wire handle. The brush shall be properly sized and shaped to brush out the probe nozzle.

2.2.2 Glass wash bottles—Two.

2.2.3 Glass sample storage containers—Chemically resistant, borosilicate glass bottles, for acetone washes, 500 ml or 1,000 ml. Screw cap closures shall be teflon rubber-backed liners or of such construction so as to be leak free and prevent chemical attack from the acetone. (Narrow mouth glass bottles have been found to be less prone to leakage.) Other types of containers must be approved by the Administrator.

2.2.4 Petri dishes—For filter samples; glass or polyethylene, unless otherwise specified by the Administrator.

2.2.5 Graduated cylinder and/or balance—To measure condensed water to within 1 ml. or 1 g. Graduated cylinders shall have subdivisions no greater than 2 ml. Most laboratory balances are capable of weighing to the nearest 0.5 g or less. Any of these balances are suitable for use here and in section 2.3.4.

2.2.6 Plastic storage containers—Air tight containers to store silica gel.

2.2.7 Funnel and rubber policeman—To aid in transfer of silica gel to container; not necessary if silica gel is weighed in the field.

2.3 Analysis.

2.3.1 Glass weighing dishes.

2.3.2 Desiccator.

2.3.3 Analytical balance—To measure to within 0.1 mg.

2.3.4 Balance—To measure to within 0.5 g.

2.3.5 Beakers—250 ml.

2.3.6 Hygrometer—To measure the relative humidity of the laboratory environment.

2.3.7 Temperature gauge—To measure the temperature of the laboratory environment.

3. *Reagents*

3.1 Sampling.

3.1.1 Filters—The in-stack filters shall be glass mats or thimble fiber filters, without organic binders, and shall exhibit at least 99.95% efficiency (≤0.05% penetration) on 0.3 micron dioctyl phthalate smoke particles. The filter efficiency tests shall be conducted in accordance with ASTM standard method D 2986–71. Test data from the supplier's quality control program is sufficient for this purpose.

3.1.2 Silica gel—Indicating type, 6–16 mesh. If previously used, dry at 175° C (350° F) for 2 hours. New silica gel may be used as received.

3.1.3 Crushed ice.

3.1.4 Stopcock grease—Acetone insoluble, heat stable silicone grease. This is not necessary if screw-on connectors with Teflon sleeves, or similar, are used.

3.2 Sample recovery.

3.2.1 Acetone—Reagent grade, ≤0.001% residue, in glass bottles. Acetone from metal containers generally has a high residue blank and should not be used. Sometimes, suppliers transfer acetone to glass bottles from metal containers. Thus, acetone blanks shall be run prior to field use and only acetone with low blank values (≤0.001%) shall be used.

3.3 Analysis.

3.3.1 Acetone—Same as 3.2.1.

3.3.2 Desiccant—Anhydrous calcium sulfate, indicating type.

4. *Procedure*

4.1 Sampling. The sampling shall be conducted by competent personnel experienced with this test procedure.

4.1.1 Pretest preparation. All the components shall be maintained and calibrated according to the procedure described in APTD–0576, unless otherwise specified herein.

Weigh approximately 200–300 g of silica gel in air tight containers to the nearest 0.5 g. Record the total weight, both silica gel and container, on each container. Larger portions of silica gel may be used, but care should be taken during sampling that the gel is not entrained and carried out of its holder. As an alternative, the silica gel may be weighed directly in its impinger or sampling holder just prior to train assembly.

Check filters visually against light for irregularities and flaws or pinhole leaks. Label filters of proper size on the back side near the edge using numbering machine ink. As an alternative, label the shipping containers (glass or plastic petri dishes) and keep the filters in these containers at all times except during sampling and weighing.

Desiccate the filters at 20±5.6° C (68±10° F) and ambient pressure for at least 24 hours and weigh at 6 or more hour intervals to a constant weight, i.e., 0.5 mg change from previous weighing, and record results to the nearest 0.1 mg. During each weighing the filter must not be exposed to the laboratory atmosphere for a period greater than 2 minutes and a relative humidity above 50%.

4.1.2 Preliminary determinations. Select the sampling site and the minimum number of sampling points according to Method 1 or as specified by the Administrator. Make a projected area model of the probe extension-filter holder assembly, with the pitot tube impact openings positioned along the centerline of the stack, as shown in Figure 17–2. If the estimated cross-section blockage, calculated as shown in Figure 17–2, exceeds 3 percent of the duct cross sectional area, then either one of the following shall be done: (1) a suitable out-stack filtration method can be used instead of in-stack filtration; or (2) a special in-stack assembly, designed to minimize blockage effects, can be used. For details concerning the latter approach, consult with the Administrator.

Determine the stack pressure, temperature, and the range of velocity heads using Method 2; determine the moisture content using Approximation Method 4 or its alternatives for the purpose of making isokinetic sampling rate calculations. Estimates may be used. However, final results will be based on actual measurements made during the test.

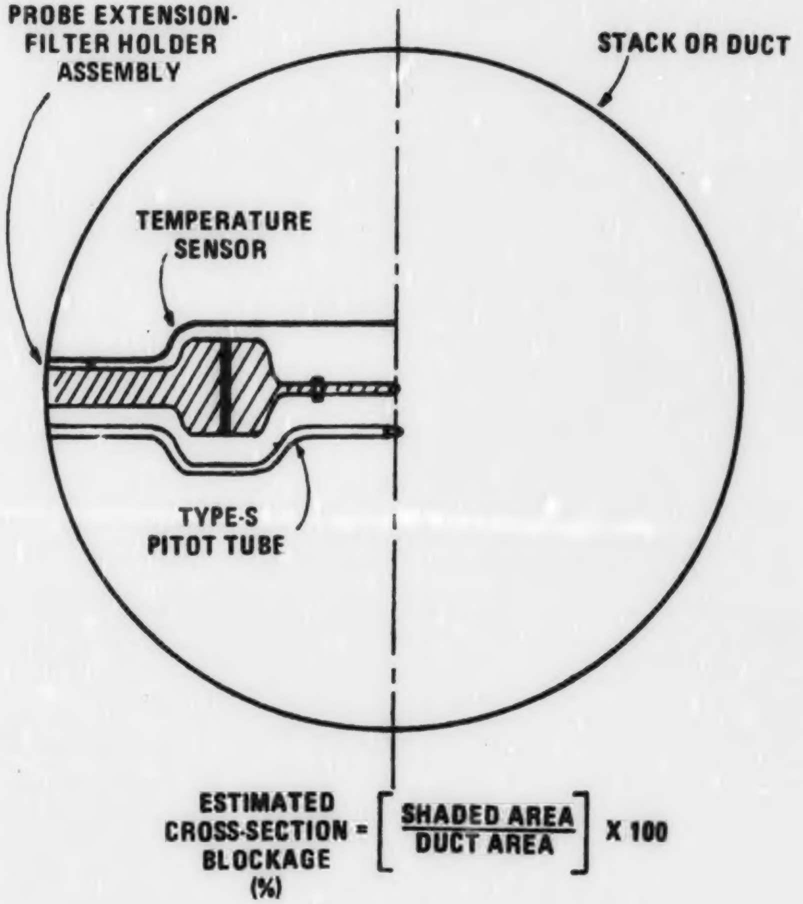
PROBE EXTENSION-FILTER HOLDER ASSEMBLY
STACK OR DUCT
TEMPERATURE SENSOR
TYPE-S PITOT TUBE
ESTIMATED CROSS-SECTION BLOCKAGE (%) = [SHADED AREA / DUCT AREA] X 100

Figure 17-2. Projected-area model of cross-section blockage (approximate average for a sample traverse) caused by in-stack filter holder-probe extension assembly.

Select a nozzle size based on the range of velocity heads such that it is not necessary to change the nozzle size in order to maintain isokinetic sampling rates. During the run, do not change the nozzle size. Ensure that the differential pressure gauge is capable of measuring the minimum velocity head value to within 10%, or as specified by the Administrator.

Select a probe extension length such that all traverse points can be sampled. Consider sampling from opposite sides for large stacks to reduce the length of probes.

Select a total sampling time greater than or equal to the minimum total sampling time specified in the test procedures for the specific industry such that the sampling time per point is not less than 2 min. (or some greater time interval if specified by the Administrator) and the sample volume taken will exceed the required minimum total gas sample volume specified in the test procedures for the specific industry. The latter is based on an approximate average sampling rate. Note also that the minimum total sample volume is corrected to standard conditions.

It is recommended that half-integral or integral numbers of minutes be sampled at each point in order to avoid timekeeping errors.

In some circumstances, e.g., batch cycles, it may be necessary to sample for shorter times at the traverse points and to obtain smaller gas sample volumes. In these cases, the Administrator's approval must first be obtained.

4.1.3 Preparation of collection train. During preparation and assembly of the sampling train, keep all openings where contamination can occur covered until just prior to assembly or until sampling is about to begin.

If impingers are used to condense stack gas moisture prepare them as follows: place 100 ml of water in each of the first two impingers; leave the third impinger empty; and transfer approximately 200–300 g or more, if necessary, of preweighed silica gel from its container to the fourth impinger; alternatively, if a balance is available in the field, the silica gel can be weighed out in a tared impinger, and its weight gain determined in the field. Place the silica gel container in a clean place for later use in the sample recovery. If some means other than impingers is used to condense moisture, prepare the condenser (and, if appropriate, silica gel for condenser outlet) for use.

Using a tweezer or clean disposable surgical gloves, place a labeled (identified) and weighed filter in the filter holder. Be sure that the filter is properly centered and the gasket properly placed so as not to allow the sample gas stream to circumvent the filter. Check filter for tears after assembly is completed. Mark the probe extension with heat resistant tape or by some other method to denote the proper distance into the stack or duct for each sampling point.

Unless otherwise specified by the Administrator, attach a temperature sensor to the probe extension so that the sensor extends beyond the leading edge of the probe extension and does not touch any metal. The sensor should be positioned at least 1.9 cm (0.75 in.) from both the pitot tube and probe nozzle to avoid interference with the gas flow (see Figure 17–1).

Assemble the train as in Figure 17–1, using (if applicable) a very light coat of silicone grease on all ground glass joints and greasing only the outer portion (see APTD–0576) to avoid possibility of contamination by the silicone grease. Place crushed ice around the impingers (if applicable).

4.1.4 Leak check procedure—After the sampling train has been assembled, a leak check of the filter holder shall be conducted as follows: Plug the inlet to the probe nozzle with a material that will be able to withstand the stack temperature; alternatively, the proble nozzle can be removed and the inlet to the filter holder plugged. Insert the holder into the stack and wait approximately 5 minutes (or longer, if necessary) to allow the system to come to equilibrium with the temperature of the stack gas stream. Turn on the pump and draw a vacuum of at least 380 mm Hg (15 in. Hg). Determine the leakage rate, if any. A leakage rate in excess of 4% of the average sampling rate or 0.00057 m³/min. (0.02 cfm), whichever is less, is unacceptable.

The following leak check instructions for the sampling train described in APTD–0576 and APTD–0581 may be helpful. Start the pump with by-pass valve fully open and coarse adjust valve completely closed. Partially open the coarse adjust valve and slowly close the by-pass valve until 380 mm Hg (15 in. Hg) vacuum is reached. Do not reverse direction of by-pass valve. If 380 mm Hg (15 in. Hg) is exceeded, either leak check at this higher vacuum or end the leak check as shown below and start over.

When the leak check is completed, first slowly remove the plug from the inlet to the probe nozzle and immediately turn off the vacuum pump. This prevents the water in the condenser from being forced backward and keeps silica gel from being entrained backward.

Leak checks shall be conducted as described whenever the train is disengaged, e.g. for silica gel or filter changes during the test, prior to each test run, and at the completion of each test run. If leaks are found to be in excess of the acceptable rate, the test will be considered invalid. To reduce lost time due to leakage occurrences, it is recommended that leak checks be conducted between port changes at the highest vacuum reading drawn during that sampling traverse.

PLANT ____________
LOCATION ____________
OPERATOR ____________
DATE ____________
RUN NO. ____________
SAMPLE BOX NO. ____________
METER BOX NO. ____________
METER ΔH@ ____________
C FACTOR ____________
PITOT TUBE COEFFICIENT, C_p ____________

SCHEMATIC OF STACK CROSS SECTION

AMBIENT TEMPERATURE ____________
BAROMETRIC PRESSURE ____________
ASSUMED MOISTURE, % ____________
PROBE EXTENSION LENGTH, m (ft) ____________
NOZZLE IDENTIFICATION NO. ____________
AVERAGE CALIBRATED NOZZLE DIAMETER, cm (in.) ____________
LEAK RATE, m³/min (cfm) ____________

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min.	STATIC PRESSURE mm Hg (in. Hg)	STACK TEMPERATURE (T_s) °C (°F)	VELOCITY HEAD (ΔP_s), mm H₂O (in. H₂O)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER mm H₂O (in. H₂O)	GAS SAMPLE VOLUME m³ (ft³)	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET °C (°F)	GAS SAMPLE TEMPERATURE AT DRY GAS METER OUTLET °C (°F)	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER, °C (°F)
TOTAL							Avg.	Avg.	
AVERAGE							Avg.		

Figure 17-3. Particulate field data.

4.1.5 Particulate train operation—During the sampling run, maintain the isokinetic sampling rate to within 10% (unless otherwise specified by the Administrator) of true isokinetic.

For each run, record the data required on the example data sheet shown in Figure 17–3. Be sure to record the initial dry gas meter reading. Record the dry gas meter readings at the beginning and end of each sampling time increment, when changes in flow rates are made, and when samplying is halted. Take other data point readings at least once at each sample point during each time increment and additional readings when significant changes (20% variation in velocity head readings) necessitate additional adjustments in flow rate. Level and zero the manometer.

Clean the portholes prior to the test run to minimize the chance of sampling the deposited material. To begin sampling, remove the nozzle cap and verify that the pitot tube and probe extension are properly positioned. Position the nozzle at the first traverse point with the tip pointing directly into the gas stream. Immediately start the pump and adjust the flow to isokinetic conditions. Nomographs, which aid in the rapid adjustment of the isoKinetic sampling rate without excessive computations, are available for use whenever the Type S pitot tube coefficient is 0.85±0.02, and the stack gas equivalent density (molecular weight) is 29±4. APTD–0576 details the procedure for using these nomographs. If C_p and M_d are outside the above stated ranges, do not use the nomograph unless appropriate steps (see Reference 7.7) are taken to compensate for the deviations.

When the stack is under significant negative pressure (height of impinger stem), take care to close the coarse adjust valve before inserting the probe into the stack. If necessary, the pump may be turned on with the coarse adjust valve closed.

When the probe is in position, block off the openings around the probe and porthole to prevent unrepresentative dilution of the gas stream.

Traverse the stack cross section, as required by Method 1 or as specified by the Administrator, being careful not to bump the probe nozzle into the stack walls when sampling near the walls or when removing or inserting the probe extension through the portholes, to minimize chance of extracting deposited material.

During the test run, take appropriate steps (e.g., adding crushed ice to the impinger ice bath) to maintain a temperature of less than 20° C (68° F) at the condenser outlet; this will prevent excessive moisture losses. Also, periodically check the level and zero of the manometer.

If the pressure drop across the filter becomes to high, making isokinetic sampling difficult to maintain, the filter may be replaced in the midst of a sample run. It is recommended that another complete filter holder-nozzle assembly be used rather than attempting to change the filter itself. After the new filter holder-nozzle assembly is installed, conduct a leak check. The particulate weight shall include the summation of all filter assembly catches.

A single train shall be used for the entire sample run, except for filter and silica gel changes. However, if approved by the Administrator, two or more trains may be used for a single test run when there are two or more ducts or sampling ports. The results shall be the total of all sampling train catches.

At the end of the sample run, turn off the pump, remove the probe extension-filter holder-nozzle assembly from the stack, and record the final dry gas meter reading. Perform a leak check at a vacuum equal to or greater than the maximum reach during sampling. Calculate percent isokinetic (see calculation section) to determine whether another test run should be made. If there is difficulty in maintaining isokinetic rates due to source conditions, consult with the Adminstrator for possible variance on the isokinetic rates.

4.2 Sample recovery. Proper cleanup procedure begins as soon as the probe extension-filter holder-nozzle assembly is removed from the stack at the end of the sampling period. Allow the assembly to cool.

When the assembly can be safely handled, wipe off all external particulate matter near the tip of the probe nozzle and place a cap over it to prevent losing or gaining particulate matter. Do not cap off the probe tip tightly while the sampling train is cooling down as this would create a vacuum in the filter holder, and force condenser water backward.

Before moving the sample train to the cleanup site, disconnect the filter holder-probe nozzle assembly from the probe extension; cap the open inlet of the probe extension. Be careful not to lose any condensate, if present. Remove the umbilical cord from the condenser outlet and cap the outlet. If a flexible line is used between the first impinger or condenser and the probe extension, disconnect the line at the probe extension and let any condensed water or liquid drain into the impingers or condenser. After wiping off the silicone grease (if applicable) cap off the condenser inlet. Ground glass stoppers, plastic caps, or serum caps (whichever are appropriate) may be used to close these openings.

Transfer both the filter holder-probe nozzle and condenser assemblies to the cleanup area. This area should be clean and protected from the wind so that the chances of contaminating or losing the sample will be minimized.

Save a portion of the acetone used for cleanup as a blank. Place about 200 ml of this acetone taken directly from the wash bottle being used in a glass sample container labeled "acetone blank."

Inspect the train prior to and during disassembly and note any abnormal conditions. Treat the samples as follows:

Container No. 1. Carefully remove the filter from the filter holder and place in its identified petri dish container. Use a pair of tweezers and/or clean disposable surgical gloves to handle the filter. If it is necessary to fold the filter, do so such that the particulate cake is inside the fold. Quantitatively remove any particulate matter and/or filter which adheres to the filter holder gasket by carefully using a dry nylon bristle brush and/or a sharp-edged blade and place into this container. Seal the container.

Container No. 2. Taking care to see that dust on the outside of the probe nozzle or other exterior surfaces does not get into the sample, quantitatively recover particulate matter or any condensate from the probe nozzle, fitting, and front half of the filter holder by washing these components with acetone and placing the wash into a glass container in the following manner; note that distilled water may be used instead of acetone when approved by the Administrator or shall be used when specified by the Administrator; in these cases, save a water blank and follow Administrator's directions on analysis;

Carefully remove the proble nozzle and clean the inside surface by rinsing with acetone from a wash bottle and brushing with a nylon bristle brush. Brush until acetone rinse shows no visible particles, after which make a final rinse of the inside surface with acetone.

Brush and rinse with acetone the inside parts of the fitting in a similar way until no visible particles remain. A funnel may be used to aid in transferring liquid washes to the container. Rinse the brush with acetone and quantitatively collect these washings in the sample container. Between sampling runs, keep brushes clean and protected from contamination.

After ensuring that all joints are wiped clean of silicone grease (if applicable), clean the inside of the front half of the filter holder by rubbing the surfaces with a nylon bristle brush and rinsing with acetone. Rinse each surface three times or more if needed to remove visible particulate. Make a final rinse of the brush and filter holder. After all acetone washings and particulate matter are collected in the sample container, tighten the lid on the sample container so that acetone will not leak out when it is shipped to the laboratory. Mark the height of the fluid level to determine whether or not leakage occurred during transport. Label container to clearly identify its contents.

Container No. 3. Note color of indicating silica gel to determine if it has been completely spent and make a notation of its condition. Transfer the silica gel back to its original container and seal. A funnel may make it easier to pour the silica gel without spilling, and a rubber policeman may be used as an aid in removing the silica gel. It is not necessary to remove the small amount of dust particles that may adhere to the walls and are difficult to remove. Since the gain in weight is to be used for moisture calculations, do not use any water or other liquids to transfer the silica gel. If a balance is available in the field, follow the procedure under "Analysis."

Condenser water. Treat the condenser or impinger water as follows: make a notation of any color or film in the liquid catch. Measure the condensate to within ±1 ml by using a graduated cylinder or, if available, to within ±0.5 g by using a balance. Record the condensate volume or weight. This information is required to calculate the moisture content of the effluent gas. Discard the liquid after measuring and recording the volume or weight.

4.3 Analysis. Record the data required on the example sheet shown in Figure 17-4. Handle each sample container as follows:

Container No. 1. Leave in shipping container or transfer the filter and any loose particulate from the sample container to a tared glass weighing dish and desiccate for 24 hours in a desiccator containing anhydrous calcium sulfate. Weight to a constant weight and report the results to the nearest 0.1 mg. For purposes of this section 4.3, the term "constant weight" means a difference of no more than 0.5 mg or 1% of total weight less tare weight, whichever is greater, between two consecutive weighings, with no less than 6 hours of desiccation time between weighings and no more than 2 minutes exposure to the laboratory atmosphere (must be less than 50% relative humidity) during weighing.

Plant ____________________

Date ____________________

Run No. ____________________

Relative Humidity ____________________

Amount liquid lost during transport ____________________

Acetone blank volume, ml ____________________

Acetone wash volume, ml ____________________

Acetone blank concentration, mg/g (equation 17-4) ____________________

Acetone wash blank, mg (equation 17-5) ____________________

CONTAINER NUMBER	WEIGHT OF PARTICULATE COLLECTED, mg		
	FINAL WEIGHT	TARE WEIGHT	WEIGHT GAIN
1			
2			
TOTAL	☒	☒	
		Less acetone blank	
		Weight of particulate matter	

<table>
<tr><th rowspan="2"></th><th colspan="3">VOLUME OF LIQUID WATER COLLECTED</th></tr>
<tr><th>CONDENSATE VOLUME, ml</th><th colspan="2">SILICA GEL WEIGHT, g</th></tr>
<tr><td>FINAL</td><td></td><td colspan="2"></td></tr>
<tr><td>INITIAL</td><td></td><td colspan="2"></td></tr>
<tr><td>LIQUID COLLECTED</td><td></td><td colspan="2"></td></tr>
<tr><td>TOTAL VOLUME COLLECTED</td><td></td><td>g*</td><td>ml</td></tr>
</table>

CONVERT WEIGHT OF WATER TO VOLUME BY DIVIDING TOTAL WEIGHT INCREASE BY DENSITY OF WATER (1g/ml)

$$\frac{\text{INCREASE, g}}{1\ \text{g/ml}} = \text{VOLUME WATER, ml}$$

Figure 17-4. Analytical data.

Container No. 2. Note level of liquid in container and confirm on analysis sheet whether or not leakage occurred during transport. Measure the liquid in this container either volumetrically to ±1 ml or gravimetrically to ±0.5 g. Transfer the contents to a tared 250 ml beaker, and evaporate to dryness at ambient temperature and pressure. Desiccate for 24 hours and weigh to a constant weight. Report the results to the nearest 0.1 mg.

Container No. 3. Weigh the spent silica gel to the nearest 0.5 g using a balance. This step may be conducted in the field.

"Acetone Blank" Container. Measure acetone in this container either volumetrically or gravimetrically. Transfer the acetone to a tared 250 ml beaker and evaporate to dryness at ambient temperature and pressure. Desiccate for 24 hours and weigh to a constant weight. Report the results to the nearest 0.1 mg.

5. *Calibration*

Maintain a laboratory log of all calibrations.

5.1 Probe nozzle. Using a micrometer, measure the inside diameter of the nozzle to the nearest 0.025 mm (0.001 in.). Make 3 separate measurements using different diameters each time and obtain the average of the measurements. The difference between the high and low numbers shall not exceed 0.1 mm (0.004 in.).

When nozzles become nicked, dented, or corroded, they shall be reshaped, sharpened, and recalibrated before use.

Each nozzle shall be permanently and uniquely identified.

5.2 Pitot tube. The pitot tube shall be calibrated separately (i.e., apart from its assembly configuration) according to the procedures outlined in Method 2 for Calibration of isolated Type S pitot tubes.

5.3 Dry gas meter and orifice meter. Both meters shall be calibrated according to the procedure outlined in APTD-0576. When a diaphragm pump is used, assure that there is no leak.

5.4 Temperature gauges. Calibrate dial and liquid filled bulb thermometers and thermocouple-potentiometer systems against mercury-in-glass thermometers. Ice bath and boiling water (corrected for barometric pressure) are acceptable reference points. For other devices, check with the Administrator.

6. *Calculations*

Carry out calculations, retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after final calculation.

6.1 Nomenclature.

A_n = Cross sectional area of nozzle, m² (ft²).
B_{ws} = Water vapor in the gas stream, proportion by volume.
C_a = Acetone blank residue concentration, mg/g.
c_s = Concentration of particulate matter in stack gas, dry basis, corrected to standard conditions, g/dscm (g dscf).
I = Percent of isokinetic sampling.
m_n = Total amount of particulate matter collected, mg.
M_w = Molecular weight of water, 18 g/g-mole (18 lb/lb-mole).
m_a = Mass of residue of acetone after evaporation, mg.
P_{bar} = Barometric pressure at the sampling site, mm Hg (in. Hg).
P_s = Absolute stack gas pressure, mm Hg (in. Hg).
P_{std} = Standard absolute pressure, 760 mm Hg (29.92 in. Hg).
R = Ideal gas constant, 0.06236 mm Hg-m³/°K-g-mole (21.83 in. Hg-ft³/°R-lb-mole).
T_m = Absolute average dry gas meter temperature (see Figure 17-3), °K (°R).
T_s = Absolute average stack gas temperature (see Figure 17-3), °K (°R).
T_{std} = Standard absolute temperature, 293° K (528° R).
V_a = Volume of acetone blank, ml.
V_{aw} = Volume of acetone used in wash, ml.
V_{lc} = Total volume of liquid collected in condenser and silica gel (see Figure 17-4), ml.
V_m = Volume of gas sample as measured by dry gas meter, dcm (dcf).
$V_{m(std)}$ = Volume of gas sample measured by the dry gas meter corrected to standard conditions, dscm (dscf).
$V_{w(std)}$ = Volume of water vapor in the gas sample corrected to standard conditions, scm (scf).
v_s = Stack gas velocity, calculated by Method 2, Equation 2-7 using data obtained from Method 17, m/sec (ft/sec).
W_a = Weight of residue in acetone wash, mg.
ΔH = Average pressure differential across the orifice meter (see Figure 17-3), mm H_2O (in. H_2O).
ρ_a = Density of acetone, mg/ml (see label on bottle).
ρ_w = Density of water, 1 g/ml (0.00220 lb/ml).
θ = Total sampling time, min.
13.6 = Specific gravity of mercury.
60 = sec/min.
100 = Conversion to percent.

6.2 Average dry gas meter temperature and average orifice pressure drop. See data sheet (Figure 17-3).

6.3 Dry gas volume. Correct the sample volume measured by the dry gas meter to standard conditions (20° C, 760 mm Hg or 68° F, 29.92 in. Hg) by using Equation 17-1.

$$V_{m(std)} = V_m \left(\frac{T_{std}}{T_m}\right)\left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{P_{std}}\right] = KV_m \left[\frac{P_{bar} + \Delta H/13.6}{T_m}\right]$$

Equation 17-1

where:
K = 0.3855 °K/mm Hg for metric units
= 17.65 °R/in. Hg for English units

6.4 Volume of water vapor.

$$V_{w(std)} = V_{lc}\left(\frac{\rho_w}{M_w}\right)\left(\frac{RT_{std}}{P_{std}}\right) = KV_{lc}$$

Equation 17-2

where
K = 0.00134 m³/ml for metric units
= 0.0472 ft³/ml for English units

6.5 Moisture content.

$$B_{ws} = \frac{V_{w(std)}}{V_{m(std)} + V_{w(std)}}$$

Equation 17-3

6.6 Acetone blank concentration.

$$C_a = \frac{m_a}{V_a \rho_a}$$

Equation 17-4

6.7 Acetone wash blank.

$$W_a = C_a V_{aw} \rho_a$$

Equation 17-5

6.8 Total particulate weight. Determine the total particulate catch from the sum of the weights obtained from containers 1 and 2 less the acetone blank (see Figure 17-4).

6.9 Particulate concentration.

$$c_s = (0.001\ \text{g/mg})\ (m_n/V_{m(std)})$$

Equation 17-6

6.10 Conversion factors:

From	To	Multiply by
scf	m^3	0.02832
g/ft^3	gr/ft^3	15.43
g/ft^3	lb/ft^3	2.205×10^{-3}
g/ft^3	g/m^3	35.31

6.11 Isokinetic variation.
6.11.1 Calculations from raw data.

$$I=\frac{100\ T_s[KV_{1c}+(V_m/T_m)(P_{bar}+\Delta H/13.6)]}{60\ \theta v_s P_s A_n} \qquad \text{Equation 17-7}$$

where:
K=0.00346 mm Hg-m³/ml-°K for metric units
=0.00267 in. Hg-ft³/ml-°R for English units
6.11.2 Calculations from intermediate values.

$$I=\frac{T_s V_{m(std)} P_{std}\ 100}{T_{std} v_s \theta A_n P_s\ 60\ (1-B_{ws})}$$

$$=K\ \frac{T_s V_{m(std)}}{P_s v_s A_n \theta (1-B_{ws})} \qquad \text{Equation 17-8}$$

where:
K=4.323 for metric units
=0.0944 for English units

6.12 (Acceptable results. If 90% ≤I≤ 110%, the results are acceptable. If the results are low in comparison to the standards and I is beyond the acceptable range, the Administrator may option to accept the results. Use reference 7.4 to make judgments. Otherwise, reject the results and repeat the test.

7. References

7.1 Addendum to Specifications for Incinerator Testing at Federal Facilities, PHS, NCAPC, Dec. 6, 1967.

7.2 Martin, Robert M., Construction Details of Isokinetic Source Sampling Equipment, Environmental Protection Agency, APTD-0581.

7.3 Rom, Jerome J., Maintenance, Calibration, and Operation of Isokinetic Source Sampling Equipment, Environmental Protection Agency, APTD-0576.

7.4 Smith, W. S., R. T. Shigehara, and W. F. Todd, A Method of Interpreting Stack Sampling Data, Paper presented at the 63rd Annual Meeting of the Air Pollution Control Association, St. Louis, Mo., June 14-19, 1970.

7.5 Smith, W. S., et al., Stack Gas Sampling Improved and Simplified with New Equipment APCA paper No. 67-119, 1967.

7.6 Specifications for Incinerator Testing at Federal Facilities, PHS, NCAPC, 1967.

7.7 Shigehara, R. T., Adjustments in the EPA Nomograph for Different Pitot Tube Coefficients and Dry Molecular Weights, Stack Sampling News 2:4-11, Oct. 1974.

[FR Doc.76-27786 Filed 9-23-76;8:45 am]

ENVIRONMENTAL PROTECTION AGENCY

[40 CFR Part 60]

[FRL 635-4]

KRAFT PULP MILLS

Standards of Performance for New Stationary Sources; Correction

In FR Doc. 76-27786 appearing at page 42012 in the FEDERAL REGISTER of September 24, 1976, the following changes should be made:

1. On page 42012, paragraph 3, line 10 is corrected to read as follows: "0.0125 g/Kg ADP is proposed for smelt."

2. On page 42016, § 60.283(a)(3) is corrected to read as follows:

§ 60.283 Standard for total reduced sulfur (TRS).

* * * * *

(a) * * *

(3) From any smelt dissolving tank any gases which contain TRS in excess of 0.0125 g/Kg ADP (0.025 lb/ton ADP).

3. On page 42020, Equation 16–2 is corrected to read as follows:

$$TRS = \Sigma(H_2S, MeSH, DMS, 2DMDS, z)d$$

4. On page 42027, Equation 17–7 is corrected to read as follows:

$$I = \frac{100\ T_s[KV_{lc} + (Vm/Tm)\ (P_{bar} + \Delta H/13.6)]}{60\ \theta v_s P_s A_n}$$

Dated: October 21, 1976.

EDWARD F. TUERK,
Acting Assistant Administrator for Air and Waste Management.

[FR Doc.76-31583 Filed 10-28-76;8:45 am]

[40 CFR Part 60]

[FRL 648-8]

KRAFT PULP MILLS

Standards of Performance for New Stationary Sources; Extension of Comment Period

On September 24, 1976 (41 FR 42012), the Environmental Protection Agency (EPA) proposed standards of performance for the control of emissions from kraft pulp mills. The notice of proposal requested public comments on the standards by November 22, 1976. Due to a delay in the printing and shipping of the Standards Support and Environmental Impact Statement, sufficient copies of the document have not been available to all interested parties in time to allow their meaningful review and comment by November 22. The public comment period is therefore being extended to allow additional time for all interested parties to participate in this rulemaking. EPA has received a request from the industry to extend the comment period by 45 days through January 7, 1977. An extension of this length does not, however, seem justified because the printing and shipping delay has resulted in only a two-week delay in processing requests for the document. EPA has therefore determined that the comment period will be extended by three weeks and all comments postmarked by December 13, 1976, will be considered. Comments should be submitted (in triplicate) to the Emission Standards and Engineering Division (MD-13), U.S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711, Attention: Mr. Don R. Goodwin.

Dated: November 19, 1976.

ROGER STRELAW,
Assistant Administrator for Air and Waste Management.

[FR Doc.76-34661 Filed 11-22-76;8:45 am]

ENVIRONMENTAL PROTECTION AGENCY

■

LIME MANUFACTURING PLANTS

Standards of Performance and Addition to List of Categories of Stationary Sources

SUBPART HH

ENVIRONMENTAL PROTECTION AGENCY

[40 CFR Part 60]

[FRL 704-1]

STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Lime Manufacturing Plants

AGENCY: Environmental Protection Agency.

ACTION: Proposed rule.

SUMMARY: The proposed standards would limit emissions of particulate matter from new, modified, and reconstructed lime manufacturing plants. The standards implement the Clean Air Act and are based on the Administrator's determination that lime manufacturing plant emissions contribute significantly to air pollution. The intended effect is to require new, modified, and reconstructed lime manufacturing plants to use the best demonstrated system of emission reduction.

DATES: Comments must be received on or before July 5, 1977.

ADDRESS: Comments should be submitted, preferably in triplicate, to the Emission Standards and Engineering Division, Environmental Protection Agency, Research Triangle Park, North Carolina 27711, Attention: Mr. Don R. Goodwin.

The Standards Support and Environmental Impact Statement (SSEIS) may be obtained from the Public Information Center (PM-215), U.S. Environmental Protection Agency, Washington, D.C. 20460 (specify "Standards Support and Environmental Impact Statement, Volume 1: Proposed Standards of Performance for Lime Manufacturing Plants").

All public comments received will be available for inspection and copying during normal business hours at EPA's Public Information Reference Unit, Room 2922 (EPA Library), 401 M Street SW., Washington, D.C.

FOR FURTHER INFORMATION CONTACT:

Don R. Goodwin, Emission Standards and Engineering Division, Environmental Protection Agency, Research Triangle Park, North Carolina 27711, telephone number 919-688-8146, extension 271.

SUPPLEMENTARY INFORMATION:

SUMMARY OF ENVIRONMENTAL AND ECONOMIC IMPACTS

The proposed standards could impact an estimated 6.8 teragrams (7.5 million tons) of lime manufacturing capacity by 1982. About one-third of that would be due to replacement of existing facilities and the remainder due to installation of equipment needed for expansion of industry capacity. EPA estimates that approximately 8 to 10 new rotary lime kilns and one new lime hydrator will be built each year for the next five years.

The proposed standards would reduce national particulate emissions from lime manufacturing plants by about 13 gigagrams (about 14,200 tons) through 1982. This reduction would be accomplished with only minimal adverse environmental impacts on water pollution and solid waste handling and disposal. National energy consumption would be decreased slightly by the equivalent of nine cubic meters or about 55 barrels of No. 6 fuel oil per day in 1982.

Total incremental investment costs through 1982 to meet the proposed standards are projected to be about $3 million. The annualized costs in 1982, including depreciation and interest, are estimated to be about [illegible] million. The potential price increase that would result from implementation of the proposed standards for new or reconstructed kilns has been estimated to be about 80 cents per megagram of lime produced, or an increase of approximately 2.6 percent. The costs for control of particulate emissions from the affected facilities are considered reasonable.

The proposed particulate standard for rotary lime kilns is based on the use of a baghouse or an electrostatic precipitator. Use of either of these systems would result in minimal adverse environmental impacts. A venturi scrubber could also be used to meet the standards. Although venturi scrubbers would result in an additional beneficial environmental impact by reducing SO_2 emissions by about 7 percent, they would also result in adverse impacts on solid waste disposal, water pollution, and energy consumption.

The proposed particulate standard for lime hydrators is based on the use of a scrubber. Since the typical State standard for this facility also requires the use of a scrubber, there would be minimal environmental impacts associated with the proposed standard. The incremental energy required is small, an increase of less than one percent. All of the collected particulate matter could be recycled to the unit along with the scrubbing water. Therefore, there would be no adverse environmental impacts on solid waste disposal or water pollution.

RATIONALE FOR THE PROPOSED STANDARDS

The proposed standards would require the best demonstrated technology, considering costs, for the control of particulate matter emissions be installed and properly operated at new, modified, and reconstructed lime manufacturing plants. The proposed standards were developed based on information derived from (1) available technical literature on the lime manufacturing industry and applicable emission control technology, (2) technical studies performed for EPA by independent research organizations, (3) information obtained from the industry during visits to lime plants and meetings with various representatives of the industry, (4) comments and suggestions solicited from experts, and (5) the results of emission measurements conducted by EPA and the industry.

It should be noted that standards of performance for new sources established under section 111 of the Clean Air Act reflect emission limits achievable with the best demonstrated systems of emission reduction considering the cost of such systems. State implementation plans (SIP's) approved or promulgated under section 110 of the Act, on the other hand, must provide for the attainment and maintenance of national ambient air quality standards (NAAQS) designed to protect public health and welfare. For that purpose SIP's must in some cases require greater emission reductions than those required by standards of performance for new sources. For example, EPA's Interpretative Ruling (41 FR 55524, December 21, 1976) on the construction of a new or modified source in an area that exceeds a NAAQS requires, among other things, that the new source must meet an emission limitation which reflects the "lowest achievable emission rate" for such type of source. At a minimum, the lowest rate achieved in practice would have to be specified unless the applicant can demonstrate that it cannot achieve such a rate. In no event could the rate exceed any applicable standard of performance for new sources.

This stringent requirement reflects EPA's judgment that a new source should be allowed to emit pollutants into an area violating a NAAQS only if its contribution to the violation is reduced to the greatest degree possible. While cost of achievement may be an important factor in determining a standard of performance for new sources applicable to all areas of the country (clean as well as dirty) as a minimum, the cost factor must be accorded far less weight in determining an appropriate emission limitation for a source locating in an area violating statutorily-mandated health and welfare standards. Thus, while there may be technology available for new sources which have been determined not to be appropriate for standards of performance purposes, because of the greater consideration of the cost factor, this technology still should be considered for purposes of determining the "lowest achievable emission rate" for such type of sources. The existence of a standard of performance for new sources should not be viewed as the ultimate in achievable control and should not limit the imposition of a more stringent standard, where appropriate.

In addition, States are free under section 116 of the Act to establish even more stringent emission limits than those established under section 111 or those necessary to attain or maintain the NAAQS under section 110, including the emission offset policy requirements outlined here. Thus, new sources may in some cases be subject to limitations more stringent than EPA's standards of performance under section 111, and prospective owners and operators of new sources should be aware of this possibility in planning for such facilities.

Selection of the Source Category, Pollutants, and Affected Facilities. Section 111 of the Act directs the Administrator to establish standards of performance for new and modified stationary sources that may contribute significantly to air pollution which causes or contributes to the endangerment of public health or welfare. Lime manufacturing plants have been shown to be a significant source of particulate matter emissions. A study performed for EPA in 1975 by The Research Corporation of New England ranked the lime industry twenty-fifth on a list of 112 stationary source categories which are emitters of particulate matter. Lime plants have also been identified as sources that are capable of contributing to the deterioration of existing air quality (39 FR 42510).

Lime plants have been selected for the development of standards of performance based on the expected growth rate of the industry, the wide range of plant locations across the United States, and the reduction in particulate emissions achievable with application of the best technology for emission control, considering costs. Since 1930, the demond for lime products has been increasing at a growth rate of about five percent per year. This rate is projected to continue through 1982. In 1975, there were 177 lime plants located in 40 states in the United States, producing a total of about 20 teragrams (22 million tons) of lime per year.

Lime plants are sources of emissions of particulate matter, nitrogen oxides (NO_x), carbon monoxide (CO), and sulfur dioxide (SO_2). For the reasons discussed below, at this time standards are proposed only for the control of particulate matter emissions.

NO_x emissions from lime kilns are generally emitted in low concentrations of about 200 ppm. NO_x emission reductions achievable through combustion modification or other control techniques have not been clearly identified for lime kilns. Standards of performance to reduce these emissions are therefore not being proposed.

CO emissions from lime plants are normally in concentrations of about 100 ppm. Emissions of this magnitude would result in an ambient air concentration of less than one percent of the primary ambient air quality standard under adverse meteorological conditions. The most effective control method for CO, incineration of the off-gasses, would create a severe fuel penalty, while producing very little environmental benefit. Consequently, standards of performance for control of CO emissions from lime kilns are not being proposed.

SO_2 emissions from lime kilns are due primarily to the presence of sulfur in the fuel used to fire the kiln. Potential emissions of SO_2 from a 907 Mg (1000 ton) per day lime kiln firing a coal of about 3 percent sulfur would amount to about 295 kg (650 pounds) per hour. Due to the reaction between the lime dust and the SO_2, however, a significant reduction in SO_2 emissions results. When dry particulate control, such as a baghouse or an ESP, is used, SO_2 emissions are reduced by about 85–90 percent. This SO_2 reduction can be increased to about 95 percent if a venturi scrubber is used for particulate control. These efficiencies are based on the results of EPA source tests performed on rotary kilns at several lime manufacturing plants.

Consideration of the potential environmental, economic and energy impacts, however, has convinced EPA to not propose an SO_2 standard which would force the use of venturi scrubbers. First, scrubbers use about six times more energy than do baghouses. (It should be noted, however, that despite the fact that this leads to SO_2 emissions from the power plant used to produce this energy, a net reduction in SO_2 emissions is achieved.)

Second, although scrubbers achieve lower actual SO_2 emissions than baghouses, concentrations of SO_2 in the ambient air may generally not be any lower. This is because the temperature of the stack gases from a scrubber is lower than that from a baghouse resulting in less efficient dispersion of the emissions.

Third, the annual operating costs associated with the use of a scrubber for particulate and SO_2 control is more than twice the costs of using a dry control system such as a baghouse. These costs are directly attributable to the increased power requirements of a scrubber. The beneficial impact of reducing SO_2 emissions that is achieved by using a scrubber, therefore, is attained at a relatively large economic impact.

This economic impact and the associated adverse environmental impact on water pollution, solid waste disposal and increased energy consumption are not considered reasonable in light of the relatively small beneficial impact on air quality. The Administrator has determined, therefore, that a standard of performance for control of SO_2 from lime kilns is not justified and an SO_2 standard is not being proposed.

Particulate matter is emitted from both the lime kiln and the lime hydrator. Potential particulate emissions from uncontrolled facilities would amount to about 15 kilograms per megagram (kg/Mg) of limestone feed from the kiln and about 20 kg/Mg of lime feed from the hydrator. The average State emission limit for both kilns and hydrators is 0.5 kg/Mg of feed. Through application of the best demonstrated emission control technology, the emissions from these facilities could be further reduced to 0.15 kg/Mg from the kiln and 0.075 kg/Mg from the hydrator. These emission rates represent incremental reductions in particulate emissions from rotary lime kilns and lime hydrators controlled to comply with the average State standard of 70 and 85 percent, respectively.

Lime kilns and hydrators account for virtually all of the particulate matter emitted from lime plants. Small amounts of fugitive particulate emissions may occur from various points in the process, but these have not been quantified and applicable control technology has not been investigated. No standards for control of fugitive emissions, therefore, are being proposed.

Rotary Lime Kilns. The lime kiln is the largest source of particulate emissions at a lime manufacturing plant. Although there are several types of kilns in use by the industry, the proposed standards would apply only to rotary kilns. Approximately 90 percent of the lime produced in the U.S. is produced in rotary kilns, and virtually all the new kilns that have been built in the last few years have been of the rotary type. The rotary kiln is the only kiln that can utilize coal for fuel and still maintain acceptable product quality. Since the lime manufacturing industry desires the capability in the future to burn coal, the present trend is to build and operate rotary kilns whenever possible.

The format of the proposed particulate standard for the kiln could be either a concentration standard or a mass-per-unit-of-limestone standard. Concentration standards are normally easier to enforce than mass standards. A concentration standard, however, would penalize the more energy efficient kiln operations. Since reduced fuel consumption results in smaller exhaust gas volumes, a concentration standard would require the most energy efficient kiln operators to achieve a higher degree of control.

The major problem usually associated with mass-per-unit-of-feed standards is determining the feed rate. The feed rate of the limestone into the kiln, however, is measured routinely at lime plants, thereby allowing the emission rate to be calculated directly. Since the mass-per-unit-of-limestone feed format is more equitable for the energy efficient lime producers, this format is used for the proposed standard.

EPA considers the following three devices to be representative of the best systems of emission reduction, considering costs, for particulate matter: (1) fabric filters, (2) electrostatic precipitators (ESP), and (3) venturi scrubbers.

Source tests were conducted on three baghouses, two ESP's and one scrubber. Particulate emissions from the test runs on the lime kilns controlled by baghouses or ESP's ranged from 0.016 to 0.290 kg/Mg of feed (0.033 to 0.580 lb/ton), and averaged 0.10 kg/Mg (0.20 lb/ton). One out of the three baghouses tested did not meet the level of the proposed standard. All three baghouses tested were operating under essentially the same conditions. However, for reasons explained in detail in the SSEIS, it is EPA's judgment that the baghouse that did not meet the level of the proposed standard does not represent the best control technology and the data obtained from that facility are not used in the selection of the proposed standard.

EPA also tested one scrubber for particulate emissions and found an emission rate of about 0.22 kg/Mg at a pressure drop of about 3.7 kilopascals (15 inches w.c.). This scrubber, however, is not considered to represent best technology. As explained in the SSEIS, a venturi scrubber with a higher pressure drop of about 5.4 kilopascals (22 inches w.c.) would meet the level of the proposed standard in EPA's judgment.

The results of the source tests on the four rotary lime kilns that were considered to represent the best control technology (two baghouses and two ESP's) support a particulate standard of 0.15 kg/Mg (0.3 lb/ton). A standard of 0.15 kilogram of particulate matter per megagram of limestone feed, therefore, is being proposed for rotary lime kilns.

Visible emissions data were gathered during particulate tests at six lime plants. All of the 1056 six-minute average opacity values were obtained as specified in EPA Reference Method 9. An analysis of the distribution of the data shows that over two-thirds of the six-minute averages were equal to zero percent opacity and over 99 percent of the readings fall between zero and 10 percent opacity. Based on these data, the proposed standard would limit visible emissions to 10 percent opacity. This would insure that the best system of emission reduction, installed to comply with the particulate standard, is properly operated and maintained.

When a scrubber is used for control of the particulate emissions, it is very difficult to accurately read visible emissions because of the steam plume that is present. Due to enforcement difficulties, an opacity standard would not be effective in this case, and EPA is therefore excluding rotary lime kilns controlled with scrubbers from the proposed opacity standard.

Lime Hydrators. Lime hydrators are also significant sources of particulate matter at lime manufacturing plants. Currently, hydrators are used to treat about 10 percent of the lime produced in the U.S. Both pressure and atmospheric lime hydrators are covered by the proposed standards.

The format of the proposed standard is a mass-per-unit-of-lime feed. A concentration format was not selected because the gas volume from the hydrator scrubber is not proportional to the production rate and therefore it is not possible to prevent dilution by correcting to zero percent oxygen and water. A low particulate concentration, therefore, would not necessarily result in a low mass emission rate. Since the feed rate of the lime into the hydrator can be easily measured, the emission rate can be calculated directly.

Scrubbers are the most widely used method of particulate control on lime hydrators. EPA source tested two scrubbers in use on atmospheric hydrators. The range of the six test runs on the two facilities was 0.032 to 0.087 kg/Mg (0.065 to 0.173 lb/ton). Compliance with the regulations is determined from an average of three test runs on an affected facility [40 CFR 60.8(f)]. The average of the three tests on the first unit was 0.04 kg/Mg (0.08 lb/T) and the average of the three tests on the second unit was 0.06 kg/Mg (0.12 lb/T). Setting the proposed standard at 0.075 kg/Mg (0.15 lb/ton) assures that the owner or operator of the hydrator would be required to install and operate the best control device.

Due to the presence of a steam plume from the scrubber stack, no accurate visible emissions readings could be taken. EPA believes that an opacity standard for this facility would be ineffective due to enforcement difficulties. No standard of performance limiting visible emissions from the hydrator, therefore, is being proposed.

CONSIDERATION OF IMPACTS

The proposed standards would reduce the particulate emissions from new lime kilns by 99 percent below the levels that would occur with no control and by 70 percent below the levels required by a typical State standard for existing sources. The proposed standards would also reduce particulate emissions from new lime hydrators by 85 percent compared to the requirements of the average State standard. The maximum 24-hour average ambient air concentration of particulate matter due to emissions from a typical lime kiln controlled to the level required by the proposed standard would be about 2.0 micrograms per cubic meter ($\mu g/m^3$).

The secondary environmental impacts due to the proposed standards would be minor. There would be no impact on water pollution. Solid waste handling and disposal problems would be minimal. All of the particulate collected from the hydrators can be returned to the process. When dry control systems are used on the lime kiln, the additional amount of solid waste generated is estimated to be about 3 percent. A negligible amount of particulate matter, sulfur dioxide, and nitrogen oxides would be discharged into the air by the power plant which supplies the additional electrical power required to meet the proposed standards.

In the absence of standards of performance, the lime manufacturing industry would be expected to follow the current trends in particulate control to meet the applicable State standards. It is estimated that 60 percent of the industry would use a baghouse, 20 percent would use a scrubber, and 20 percent would use an ESP for control. The expected distribution of control techniques to comply with the proposed standards is 80 percent baghouse control and 20 percent ESP control. The difference in energy consumption between these two forecasted distributions in the use of various emission control techniques amounts to an energy savings of about 12.6×10^6 kw-hr/yr in 1982. This is equivalent to approximately 9 m^3 (55 barrels) of oil per day in 1982 and represents a total energy savings of about 0.2 percent for a new lime manufacturing plant.

The control costs that new, modified, and reconstructed lime plants would incur to meet the emission level required by the proposed standards are considered reasonable. The capital costs for typical new lime plants would be increased by about 3.5 percent. The price of the lime product would increase by only about three percent. The proposed standards, therefore, are expected to have minimal impact on the future growth rate of the lime industry.

TESTING, MONITORING, AND RECORDKEEPING

Performance tests to determine compliance with the proposed standards would be required. Reference Method 5 (40 CFR Part 60, Appendix A) would be used to measure the amount of particulate emissions. In addition, Method 2 for velocity and volumetric flow rate, Method 3 for gas analysis, and Method 4 for stack gas moisture would be used to determine the necessary emission data.

A measurement of the mass rate of feed would also be required during a performance test, because the units of the proposed standards for the rotary lime kiln and the hydrator are kilograms of particulate per megagram of limestone or lime feed. A measuring device such as a conveyor belt scales would be required to determine the mass rate of feed. This device must be accurate to within ±5 percent over its operating range.

The proposed standards would require continuous monitoring of the opacity of the visible emissions discharged from the lime kiln. When a scrubber is used to control the emissions, entrained water droplets prevent the accurate measurement of opacity; therefore, in this case the proposed standard would require monitoring the pressure drop across the scrubber and the scrubbing fluid supply pressure to the scrubber rather than opacity. The pressure sensor or tap for the monitoring device used on the kiln scrubber should be located close to the scrubber liquid discharge point. The Administrator may be consulted for approval of alternative locations.

No opacity data were obtained for emissions from the lime hydrator, and no opacity standard is being proposed. Monitoring of the operating parameters of the scrubber presents a good indication of scrubber performance. The proposed regulations therefore require monitoring of the water flow rate to the scrubber and of the electric current used by the scrubber rather than opacity.

Excess emissions for the lime kiln are defined as all six-minute periods in which the average opacity of the stack plume exceeds 10 percent. The provisions for the reporting of these excess emissions are contained in § 60.7(c) of Part 60. No definition of excess emissions from lime hydrators is included in the proposed regulations since no opacity standard has been developed.

Records of performance tests and continuous monitoring system measurements would have to be retained for at least two years following the date of the measurements by owners and operators subject to this subpart. This requirement is included under § 60.7(d) of the general provisions of Part 60.

MISCELLANEOUS

As prescribed by section 111 of the Act, this proposal of standards has been preceded by the Administrator's determination that emissions from lime manufacturing plants contribute to air pollution which causes or contributes to the endangerment of public health or welfare, and by his publication of this determination in this issue of the FEDERAL REGISTER. In accordance with section 117 of the Act, publication of these proposed standards was preceded by consultation with appropriate advisory committees, independent experts, and Federal departments and agencies.

Interested persons are invited to participate in this rulemaking. The administrator will welcome comments on all aspects of the proposed regulations, including the designation of the source category of lime manufacturing plants as a significant contributor to air pollution which causes or contributes to the endangerment of public health or welfare, economic and technological issues, and the proposed test methods.

Economic Impact Analysis. The screening criteria used by EPA to determine if a proposal is a major action under the Economic Impact Statement program are: (1) additional national annualized compliance costs, including capital charges, will total $100 million within any calendar year by the attainment date, if applicable, or within five years of implementation; (2) total additional cost of production is more than five percent of the selling price; and (3) net national energy consumption will be increased by the equivalent of 25,000 barrels of oil a day (ca. 4,000 m^3 per day). EPA has determined that the impacts associated with the proposal of these standards of performance do not exceed these screening criteria. This action, therefore, does not contain a major proposal requiring preparation of an Economic Impact Analysis under Executive Orders 11821 and 11949 and OMB Circular A-107.

Authority. This notice of proposed rulemaking is issued under the authority of sections 111, 114 and 301(a) of the Clean Air Act, as amended, Pub. L. 91-604, 84 Stat. (42 U.S.C. 1857c-6, 1857c-9, 1857g(a)).

Dated: April 20, 1977.

DOUGLAS M. COSTLE,
Administrator.

It is proposed to amend Part 60 of Chapter I of Title 40 of the Code of Federal Regulations as follows:

1. By adding subpart HH as follows:

Subpart HH—Standards of Performance for Lime Manufacturing Plants

Sec.
60.340 Applicability and designation of affected facility.
60.341 Definitions.
60.342 Standard for particulate matter.
60.343 Monitoring of emissions and operations.
60.344 Test methods and procedures.

AUTHORITY: Secs. 111 and 301(a), Clean Air Act, as amended by sec. 4(a) and sec. 15(c)(2) of Pub. L. 91-604, 84 Stat. 1683, 1713; 81 Stat. 504 (42 U.S.C. 1857c-6, 1857g(a)); secs. 60.343 and 60.344 also issued under sec. 114 Clean Air Act, as amended by sec. 4(a) of Pub. L. 91-604, 84 Stat. 1687 (42 U.S.C. 1857c-9).

Subpart HH—Standards of Performance for Lime Manufacturing Plants

§ 60.340 Applicability and designation of affected facility.

The provilsons of this subpart are applicable to the following affected facilities used in the manufacture of lime: rotary lime kilns and lime hydrators.

§ 60.341 Definitions.

As used in this subpart, all terms not defined herein shall have the same meaning given them in the Act and in subpart A of this part.

(a) "Lime manufacturing plant" includes any plant which produces a lime product from limestone by calcination. Hydration of the lime product is also considered to be part of the source.

(b) "Lime product" means the product produced by the calcination process including, but not limited to, calcitic lime, dolomitic lime, and dead-burned dolomite.

(c) "Rotary lime kiln" means a unit with an inclined rotating drum which is used to produce a lime product from limestone by calcination.

(d) "Lime hydrator" means a unit used to produce hydrated lime product.

§ 60.342 Standard for particulate matter.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere:

(1) From any rotary lime kiln any gases which: (i) Contain particulate matter in excess of 0.15 kilogram per megagram of limestone feed; (ii) Exhibit 10 percent opacity or greater.

(2) From any lime hydrator any gases which contain particulate matter in excess of 0.075 kilogram per megagram of lime feed.

§ 60.343 Monitoring of emissions and operations.

(a) The owner or operator subject to the provisions of this subpart shall install, calibrate, maintain, and operate a continuous monitoring system, except as provided in paragraph (b) of this section, to monitor and record the opacity of the gases discharged into the atmosphere from any rotary lime kiln. The span of this system shall be set at 40 percent opacity.

(b) The owner or operator of any rotary lime kiln using a wet scrubbing emission control devise subject to the provisions of this subpart shall not be required to monitor the opacity of the gases discharged as required in paragraph (a) of this section, but shall install, calibrate, maintain, and operate the following continuous monitoring devices:

(1) A monitoring device for the continuous measurement of the pressure loss of the gas stream through the scrubber. The monitoring device must be accurate within ±250 pascals gauge pressure.

(2) A monitoring device for the continuous measurement of the scrubbing liquid supply pressure to the control device. The monitoring device must be accurate within ±5 percent of design scrubbing liquid supply pressure.

(c) The owner or operator of any lime hydrator using a wet scrubbing emission control device subject to the provisions of this subpart shall install, calibrate, maintain, and operate the following continuous monitoring devices:

(1) A monitoring device for the continuous measuring of the scrubbing liquid flow rate. The monitoring device must be accurate within ±5 percent of design scrubbing liquid flow rate.

(2) A monitoring device for the continuous measuring of the electric current, in amperes, used by the scrubber. The monitoring device must be accurate within ±10 percent over its normal operating range.

(d) For the purpose of conducting a performance test under § 60.8, the owner or operator of any lime manufacturing plant subject to the provisions of this subpart shall install, calibrate, maintain and operate a device for measuring the mass rate of limestone feed to any affected rotary lime kiln and the mass rate of lime feed to any affected lime hydrator. The measuring device used must be accurate to within ±5 percent of the mass rate over its operating range.

(e) For the purpose of reports required under § 60.7(c), periods of excess emissions that shall be reported are defined as all six-minute periods during which the average opacity of the plume from any lime kiln subject to paragraph (a) of this subpart exceeds 10 percent.

§ 60.344 Test methods and procedures.

(a) Reference methods in Appendix A of this part, except as provided under § 60.8(b) shall be used to determine compliance with § 60.322(a) as follows:

(1) Method 5 for the measurement of particulate matter,

(2) Method 1 for sample and velocity traverses,

(3) Method 2 for velocity and volumetric flow rate,

(4) Method 3 for gas analysis,

(5) Method 4 for stack gas moisture, and

(6) Method 9 for visible emissions.

(b) For Method 5, the sampling time for each run shall be at least 60 minutes and the sampling rate shall be at least 0.85 dscm/hr (0.53 dscf/min), except that shorter sampling times, when necessitated by process variables or other factors, may be approved by the Administrator.

[FR Doc.77-12463 Filed 5-2-77;8:45 am]

ENVIRONMENTAL PROTECTION AGENCY

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STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Amendments to Reference Methods

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ENVIRONMENTAL PROTECTION AGENCY

[40 CFR Part 60]

[FRL 718-7]

STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Proposed Revision of Reference Method 11

AGENCY: Environmental Protection Agency.

ACTION: Proposed rule.

SUMMARY: The Environmental Protection Agency (EPA) proposes a revision to Reference Method 11, the method for determining the hydrogen sulfide content of fuel gas streams. EPA has found that interferences resulting from the presence of mercaptans in some petroleum refinery fuel gases can lead to erroneous results when using the current method. This proposed revision would eliminate the problem of mercaptan interferences and insure the accuracy of test methods.

DATES: Comments must be received on or before July 22, 1977.

ADDRESS: Comments should be submitted in triplicate to the Emission Standards and Engineering Division, Environmental Protection Agency, Research Triangle Park, North Carolina 27711, Attention: Mr. Don R. Goodwin.

All public comments received will be available for inspection and copying during normal business hours at EPA's Public Information Reference Unit, Room 2922 (EPA Library), 401 M Street SW., Washington, D.C.

FOR FURTHER INFORMATION CONTACT:

Don R. Goodwin, Emission Standards and Engineering Division, Environmental Protection Agency, Research Triangle Park, North Carolina 27711 (919-688-8146), extension 271.

SUPPLEMENTARY INFORMATION: On March 8, 1974, the Environmental Protection Agency (EPA) promulgated standards of performance limiting emissions of sulfur dioxide from new, modified, and reconstructed fuel gas combustion devices within petroleum refineries. The standard limits the hydrogen sulfide content of fuel gas fired in combustion devices to 230 mg/dscm. Reference Method 11 was promulgated with the standard as the performance test method for measuring H_2S in the fuel gases. After promulgation, EPA discovered that interference resulting from the presence of mercaptans in some refinery fuel gases can lead to erroneous results. A study found that the cadmium hydroxide/cadmium sulfate absorbing solution specified in Method 11 was an efficient collector of mercaptans as well as hydrogen sulfide, thus causing a serious interference when mercaptans are present in significant concentrations. Studies were also made examining other substances often present in refinery fuel gases. No measurable interference resulted from the presence of carbon oxysulfide, dimethyl sulfoxide, ethylene, or thiophene. Acetaldehyde and acetone were observed to interfere at the 2,400 and 48,000 mg/m³ level, respectively.

As a result of this study, revisions to Method 11 are being proposed. The major change would substitute a new absorbing solution that is essentially free from mercaptan interference. New sections would also be added describing the range and sensitivity, interferences, and precision and accuracy of the revised Method 11. Although mercaptans are seldom present in fuel gases in sufficient quantities to significantly affect the test results, the proposed revision would ensure the accuracy of results in cases where high levels are present.

This revision of Method 11 does not affect the stringency of the standard for fuel gas combustion devices within petroleum refineries. The source test emission data which served as the basis for the standard were gathered at sources with negligible concentration levels of mercaptans in the fuel gas.

(Secs. 111, 114, 301(a), Clean Air Act, as amended, Pub. L. 91-604, 84 Stat. 1678 (42 U.S.C. 1857c-6, 1857c-9, and 1857g(a)).)

ECONOMIC IMPACT ANALYSIS: The Environmental Protection Agency has determined that this document does not contain a major proposal requiring preparation of an Economic Impact Analysis under Executive Orders 11821 and 11949 and OMB Circular A-107.

Dated: May 6, 1977.

DOUGLAS M. COSTLE,
Administrator.

It is proposed to amend Part 60 of Chapter I of Title 40 of the Code of Federal Regulations by revising Method 11 of Appendix A—Reference Methods as follows:

APPENDIX A—REFERENCE METHODS

* * * * *

METHOD 11—DETERMINATION OF HYDROGEN SULFIDE CONTENT OF FUEL GAS STREAMS AT STATIONARY SOURCES

1. *Principle and applicability*.—1.1 *Principle*. Hydrogen sulfide (H_2S) is collected from a source in a series of midget impingers and absorbed in ph. 3.0 cadmium sulfate ($CdSO_4$) solution to form cadmium sulfide (CdS). The latter compound is then measured iodometrically. An impinger containing hydrogen peroxide is included to remove SO_2 as an interfering species.

1.2. *Applicability*. This method is applicable for the determination of the hydrogen sulfide content of fuel gas streams at stationary sources.

2. *Range and sensitivity*. The limit of detection is approximately 8 mg/m³ (6 ppm). The maximum of the range is 740 mg/m³ (520 ppm).

3. *Interferences*. Any compound that reduces iodine or oxidizes iodide ion will interfere in this procedure, provided it is collected in the cadmium sulfate impingers. Sulfur dioxide in concentrations of up to 2,600 mg/m³ is eliminated by the hydrogen peroxide solution. Thiols precipitate with hydrogen sulfide. In the absence of H_2S, only co-traces of thiols are collected. When methane- and ethane-thiols at a total level of 300 mg/m³ are present in addition to H_2S, the results vary from 2 percent low at an H_2S concentration of 400 mg/m³ to 14 percent high at an H_2S concentration of 100 mg/m³. Carbon oxysulfide of 20 percent does not interfere. Certain carbonyl-containing compounds react with iodine and produce recurring end points. However, acetaldehyde and acetone at concentrations of 1 and 3 percent, respectively, do not interfere.

Entrained hydrogen peroxide produces a negative interference equivalent to 100 percent of that of an equimolar quantity of hydrogen sulfide. Avoid the ejection of hydrogen peroxide into the cadmium sulfate impingers.

4. *Precision and accuracy*. Collaborative testing has shown the within-laboratory coefficient of variation to be 2.2 percent and the overall coefficient of variation to be 5.0 percent. The method bias was shown to be −4.8 percent when only H_2S was present. In the presence of the interferences cited in Section 3, the bias was positive at low H_2S concentrations and negative at higher concentrations. At 230 mg H_2S/m³, the level of the compliance standard, the bias was +2.7 percent. Thiols had no effect on the precision.

5.1 *Apparatus*.

5.1.1 Sampling line. Six to 7 mm (1/4 in.) Teflon[1] tubing to connect sampling train to sampling valve. Depending on sampling stream pressure, a pressure-reduction regulator may be required just prior to the Teflon sampling line.

If significant amounts of water or amine are present in the sample stream, a corrosion-resistant cold trap should be used immediately after the sample tap. The trap should not be operated below 0°C to avoid condensation of C_3 or C_4 hydrocarbons.

5.1.2 Impingers. Five midget impingers, each with 30 ml capacity. The internal diameter of the impinger tip must be 1.00 mm ±0.05 mm. The impinger tip must be positioned 4 to 6 mm from the bottom of the impinger.

5.1.3 Glass or Teflon connecting tubing for the impingers.

5.1.4 Ice bath container—To maintain absorbing solution at a low temperature.

5.1.5 Silica gel drying tube. To protect pump and dry gas meter

5.1.6 Sampling valve. Needle valve or equivalent to adjust gas flow rate. Stainless steel or other corrosion-resistant material.

5.1.7 Dry gas meter. Sufficiently accurate to measure sample volume to within 1 percent and calibrated with a wet test meter over the range of flow rates used in sampling. Gas volume for one dial revolution must not be more than 10 liters. The gas meter should have a gas petcock or equivalent on the outlet connector which can be closed during the leak test.

5.1.8 Flow meter. Rotameter or equivalent, to measure 0.5 to 2.0 liters/min (1 to 4 CFH) flow rate.

5.1.9 Graduated cylinder. 25 ml size.

5.1.10 Barometer. To measure atmospheric pressure to within ±2.5 mm (0.1 in.) Hg.

5.1.11 U-Tube manometer. 0–30 cm water column. For leak check procedure.

5.1.12 Rubber squeeze bulb. To pressurize train for leak check.

5.1.13 Tee, pinchclamp, and connecting tubing. For leak check.

5.1.14 Vacuum pump. Required for air purge.

5.1.15 Needle valve or orifice. To set air purge flow to 1 liter/min.

5.1.16 Tube packed with active carbon. To filter air during purge.

5.1.17 Volumetric flask. One 1,000 ml.

5.1.18 Volumetric pipette. One 15 ml.

5.2 Sample Recovery.

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[1] Mention of trade names of specific products does not constitute endorsement by the Environmental Protection Agency.

5.2.1 Sample container. Iodine flask, glass-stoppered; 500 ml size.

5.2.2 Pipette. 50 ml volumetric type.

5.2.3 Graduated cylinders. One each 25 and 250 ml.

5.2.4 Flasks. 125 ml, Erlenmeyer.

5.2.5 Wash bottle.

5.2.6 Volumetric flasks. Three 1,000 ml.

5.3 Analysis.

5.3.1 Flask. 500 ml glass-stoppered iodine flask.

5.3.2 Burette. 50 ml.

5.3.3 Flask. 125 ml, Erlenmeyer.

5.3.4 Pipettes, volumetric. One 25 ml; two each 50 and 100 ml.

5.3.5 Volumetric flasks. One 1,000 ml; two 500 ml.

5.3.6 Graduated cylinders. One each 10 and 100 ml.

6. *Reagents*. Unless otherwise indicated, it is intended that all reagents conform to the specifications established by the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available. Otherwise, use best available grade.

6.1 Sampling.

6.1.1 Cadmium sulfate absorbing solution. Dissolve 41.0 g of $3CdSO_4 \cdot 8H_2O$ and 15.0 ml of 0.1 M sulfuric acid in a 1-liter volumetric flask that contains approximately ¾ liter of deionized distilled water. Dilute to volume with deionized water. Mix thoroughly. pH should be 3.0±0.1. Add 10 drops of Dow-Corning Antifoam B[1]. Shake well before use. If Antifoam B is not used, the alternate acidified iodine extraction procedure must be used.

6.1.2 Hydrogen perioxide, 3 percent. Dilute 30 percent hydrogen peroxide to 3 percent as needed. Prepare fresh daily.

6.1.3 Water. Deionized, distilled, to conform to ASTM specifications D1193-72, Type 3.

6.2 Sample recovery.

6.2.1 Tydrochloric acid solution (HCl), 3M. Add 240 ml of concentrated HCl (specific gravity 1.19) to 500 ml of deionized, distilled water in a 1-liter volumetric flask. Dilute to 1 liter with deionized water. Mix thoroughly.

6.2.2 Iodine solution, 0.1 N. Dissolve 24 g of potassium iodide (KI) in 30 ml of deionized, distilled water. Add 12.7 g of resublimed iodine (I_2) to the potassium iodide solution. Shake the mixture until the iodine is completely dissolved. If possible, let the solution stand overnight in the dark. Slowly dilute the solution to 1 liter with deionized, distilled water, with swirling. Filter the solution if it is cloudy. Store solution in a brown-glass reagent bottle.

6.2.3 Standard iodine solution, 0.01 N. Pipette 100.0 ml of the 0.1 N iodine solution into a 1 liter volumetric flask and dilute to volume with deionized, distilled water. Standardize daily as in Section 8.1. This solution must be protected from light. Reagent bottles and flasks must be kept tightly stoppered.

6.3 Analysis.

6.3.1 Sodium thiosulfate solution, standard 0.1 N. Dissolve 24.8 g of sodium thiosulfate penthahydrate ($Na_2S_2O_3 \cdot 5H_2O$) or 15.8 g of anhydrous sodium thiosulfate ($Na_2S_2O_3$), in 1 liter of deionized distilled water and add 0.01 g of anhydrous sodium carbonate (Na_2CO_3) and 0.4 ml of chloroform ($CHCl_3$) to stabilize. Mix thoroughly by shaking or by aerating with nitrogen for approximately 15 min and store in a glass-stoppered, reagent bottle. Standardize as in Section 8.2.

6.3.2 Sodium thiosulfate solution, standard 0.01 N. Pipette 50.0 ml of the standard 0.1 N thiosulfate solution into a volumetric flask and dilute to 500 ml with distilled water.

6.3.3 Starch indicator solution. Suspend 10 g of soluble starch in 100 ml of deionized, distilled water and add 15 g of potassium hydroxide (KOH) pellets. Stir until dissolved, dilute with 900 ml of deionized distilled water and let stand for 1 hour. Neutralize the alkali with concentrated hydrochloric acid, using an indicator paper similar to Alkacid test ribbon, then add 2 ml of glacial acetic acid as a preservative.

NOTE.—Test starch indicator solution for decomposition by titrating with 0.01 N iodine solution 4 ml of starch solution in 200 ml of distilled water that contains 1 g potassium iodide. If more than 4 drops of the 0.01 N iodine solution are required to obtain the blue color, a fresh solution must be prepared.

7. *Procedure*. 7.1 Sampling.

7.1.1 Assemble the sampling train as shown in Figure 11-1, connecting the five midget impingers in series. Place 15 ml of 3 percent hydrogen peroxide solution in the first impinger. Leave the second impinger empty. Place 15 ml of the cadmium sulfate absorbing solution in the third, fourth, and fifth impingers. Place the impinger assembly in an ice bath container and place crushed ice around the impingers. Add more ice during the run, if needed.

7.1.2 Connect the rubber bulb and manometer to first impinger, as shown in Figure 11-1. Close the petcock on the dry gas meter outlet. Pressurize the train to 30-cm water pressure with the bulb and close off tubing connected to rubber bulb. Train must hold a 30-cm water pressure with not more than a 1 cm drop in pressure in a 1-min interval. Stopcock grease is acceptable for sealing ground glass joints.

7.1.3 Purge the connecting line between the sampling valve and the first impinger. Close valve and connect the sample line to the train. Open the petcock on the dry gas meter outlet. Record the initial reading on the dry gas meter.

7.1.4 Open the sampling valve and then adjust the valve to obtain a rate of approximately 1 liter/min. Maintain a constant flow rate during the test. Record the meter temperature.

7.1.5 Sample for at least 10 min. At the end of the sampling time, close the sampling valve and record the final volume and temperature readings.

7.1.6 Disconnect the impinger train from the sampling line. Connect the charcoal tube and the pump, as shown in Figure 11-1. Purge the train with clean ambient air for 15 min to ensure that all H_2S is removed from the hydrogen peroxide. For sample recovery, cap the open ends and remove to a clean area that is away from sources of heat. The area should be well lighted, but not exposed to direct sunlight.

7.2 Sample recovery.

7.2.1 Discard the contents of the hydrogen peroxide impinger. Carefully rinse the contents of the third, fourth, and fifth impingers into a 500 ml iodine flask.

NOTE 2.—The impingers normally have only a thin film of cadmium sulfide remaining after a water rinse. If Antifoam B was not used or if significant quantities of yellow cadmium sulfide remain in the impingers, the alternate recovery procedure must be used.

7.2.2 Pipette exactly 50 ml of 0.01 N iodine solution into a 125 ml Erlenmeyer flask. Add 10 ml of 3 M HCl to the solution. Quantitatively rinse the acidified iodine into the iodine flask. Stopper the flask immediately and shake briefly.

7.2.2 (Alternate). Extract the remaining cadmium sulfide from the third, fourth, and fifth impingers using the acidified iodine solution. Immediately after pouring the acidified iodine into an impinger, stopper it and shake for a few moments, then transfer the liquid to the iodine flask. Do not transfer any rinse portion from one impinger to another; transfer it directly to the iodine flask. Once the acidified iodine solution has been poured into any glassware containing cadmium sulfide, the container must be tightly stoppered at all times except when adding more solution, and this must be done as quickly and carefully as possible. After adding any acidified iodine solution to the iodine flask, allow a few minutes for absorption of the H_2S before adding any further rinses. Repeat the iodine extraction until all cadmium sulfide is removed from the impingers. Extract that part of the connecting glassware that contains visible cadmium sulfide.

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[1] Mention of trade names of specific products does not constitute endorsement by the Environmental Protection Agency.

Quantitively rinse all of the iodine from the impingers, connectors, and the beaker into the iodine flask using deionized, distilled water. Stopper the flask and shake briefly.

7.2.3 Allow to stand about 30 min. in the dark for absorption of the H_2S into the iodine, then complete the titration analysis as in Section 7.3.

NOTE 3.—Caution! Iodine evaporates from acidified iodine solutions. Samples to which acidified iodnie have been added may not be stored, but must be analyzed in the time schedule stated in Section 7.2.3.

7.2.4. Prepare a blank by adding 45 ml of cadmium sulfate absorbing solution to an iodine flask. Pipette exactly 50 ml of 0.01 iodine solution into a 125-ml Erlenmeyer flask. Add 10 ml of 3 M HCl. Follow the same impinger extracting and quantitative rinsing procedure carried out in sample analysis. Stopper the flask, shake briefly, let stand 30 min in the dark, and titrate with the samples.

NOTE 4.—The blank must be handled by exactly the same procedure as that used for the samples.

7.3 Analysis.

NOTE 5.—Titration analyses should be conducted at the sample-cleanup area in order to prevent loss of iodine from the sample. Titration should never be made in direct sunlight.

7.3.1 Using 0.01 N sodium thiosulfate solution, rapidly titrate samples in iodine flasks using gentle mixing, until solution is light yellow. Add 4 ml of starch indicator solution and continue titrating slowly until the blue color just disappears. Record V_T, the volume of sodium thiosulfate solution used (ml).

7.3.2 Titrate the blanks in the same manner as the samples. Run blanks each day until replicate values agree within 0.05 ml. Average the replicate titration values which agree within 0.05 ml.

8. *Calibration and standards.* 8.1 Standarize the 0.01 N iodine solution daily as follows: Pipette 25 ml of the iodine solution into a 125 ml Erlenmeyer flask. Add 2 ml of 3 M HCl. Titrate rapidly with standard 0.01 N thiosulfate solution until the solution is light yellow, using gentle mixing. Add four drops of starch indicator solution and continue titrating slowly until the blue color just disappears. Record V_T, the volume of thiosulfate solution used (ml). Repeat until replicate values agree within 0.05 ml. Average the replicate titration values which agree within 0.05 ml and calculate the exact normality of the iodine solution using Equation 9.1. Repeat the standardization daily.

8.2 Standardize the 0.1 N thiosulfate solution as follows: Oven-dry potassium dichromate ($K_2Cr_2O_7$) at 180 to 200°C. Weight to the nearest milligram, 2 g of potassium dichromate into a 500 ml volumetric flask, dissolve in deionized, distilled water and dilute to exactly 500 ml. In a 500 ml iodine flash, dissolve approximately 3 g of potassium iodide (KI) in 45 ml of deionized, distilled water, then add 10 ml of 3 M hydrochloric acid solution. Pipette 50 ml of the dichromate solution into this mixture. Gently swirl the solution once and allow it to stand in the dark for 5 min. Dilute the solution with 100 to 200 ml of deionized distilled water, washing down the sides of the flask with part of the water. Titrate with 0.1 N thiosulfate until the solution is light yellow. Add 4 ml of starch indicator and continue titrating slowly to a green end point. Record V_T, the volume of thiosulfate solution used (ml). Repeat until replicate analyses agree within 0.05 ml. Calculate the normality using Equation 9.2. Repeat the standardization each week.

9. *Calculations.* Carry out calculations retaining at least one extra decimal figure beyond that of the acquired data. Round off results only after the final calculation.

9.1 Normality of the Standard Iodine Solution.

$$N_I = \frac{N_T V_T}{V_I}$$

where

N_I = normality of iodine, g-eq/liter;
V_I = volume of iodine used, ml;
N_T = normality of sodium thiosulfate, g-eq/liter; and
V_T = volume of sodium thiosulfate used, ml.

9.2 Normality of the Standard Thiosulfate Solution.

$$N_T = 2.04 \frac{W}{V_T}$$

where

W = weight of $K_2CR_2O_7$ used, g;
V_T = volume of $Na_2S_2O_3$ used, ml;
N_T = normality of standard thiosulfate solution, g-eq liter; and
2.04 = conversion factor.

$$= \frac{(6 \text{ eq } I_2/\text{mole } K_2Cr_2O_7)\ (1{,}000 \text{ ml/liter})}{(294.2 \text{ g } K_2Cr_2O_7/\text{mole})\ (10 \text{ aliquot factor})}$$

9.3 Dry Gas Volume. Correct the sample volume measured by the dry gas meter to standard conditions (20° C) and 760 mm Hg.

$$V_{m_{std}} = V_m \left(\frac{T_{std}}{T_m}\right) \left(\frac{P_{bar}}{P_{std}}\right)$$

where

$V_{m_{std}}$ = volume at standard conditions of gas sample through the dry gas meter, standard liters;
V_m = volume of gas sample through the dry gas meter (meter conditions), liters;
T_{std} = absolute temperature at standard conditions, 293 K;
T_m = average dry gas meter temperature, °K;
P_{bar} = barometric pressure at the orifice meter, mm Hg; and
P_{std} = absolute pressure at standard conditions, 760 mm Hg.

9.4 Concentration of H_2S. Calculate the concentration of H_2S in the gas stream at standard conditions using equation:

$$C_{H_2S} = \frac{K[(V_I N_I - V_T N_T) \text{ sample} - (V_I N_I - V_T N_T) \text{ blank}]}{V_{m_{std}}}$$

where (metric units);

C_{H_2S} = concentration of H_2S at standard conditions, mg/dscm;
K = conversion factor = 17.0×10^3

$$= \frac{(34.07 \text{ g/mole } H_2S)(1{,}000 \text{ liters/m}^3)(1{,}000 \text{ mg/g})}{(1{,}000 \text{ ml/liter})(2H_2S \text{ eq/mole})}$$

V_I = volume of standard iodine solution, ml;
N_I = normality of standard iodine solution, g-eq/liter;
V_T = volume of standard sodium thiosulfate solution, ml;
N_T = normality of standard sodium thiosulfate solution, g-eq/liter; and
$V_{m_{std}}$ = dry gas volume at standard conditions, liters.

10. *Stability.* The absorbing solution is stable for at least 1 month. Sample recovery and analysis should begin within 1 hour of sampling to minimize oxidation of the acidified cadmium sulfide. Once iodine has been added to the sample, the remainder of the analysis procedure must be completed according to Sections 7.2.2, 7.2, and 7.3.

11. *Bibliography.* 1. "Determination of Hydrogen Sulfide, Ammoniacal Cadmium Chloride Method, API Method 772–54." In: Manual on Disposal of Refinery Wastes, Vol. V: Sampling and Analysis of Waste Gases and Particulate Matter, American Petroleum Institute, Washington, D.C., 1954.

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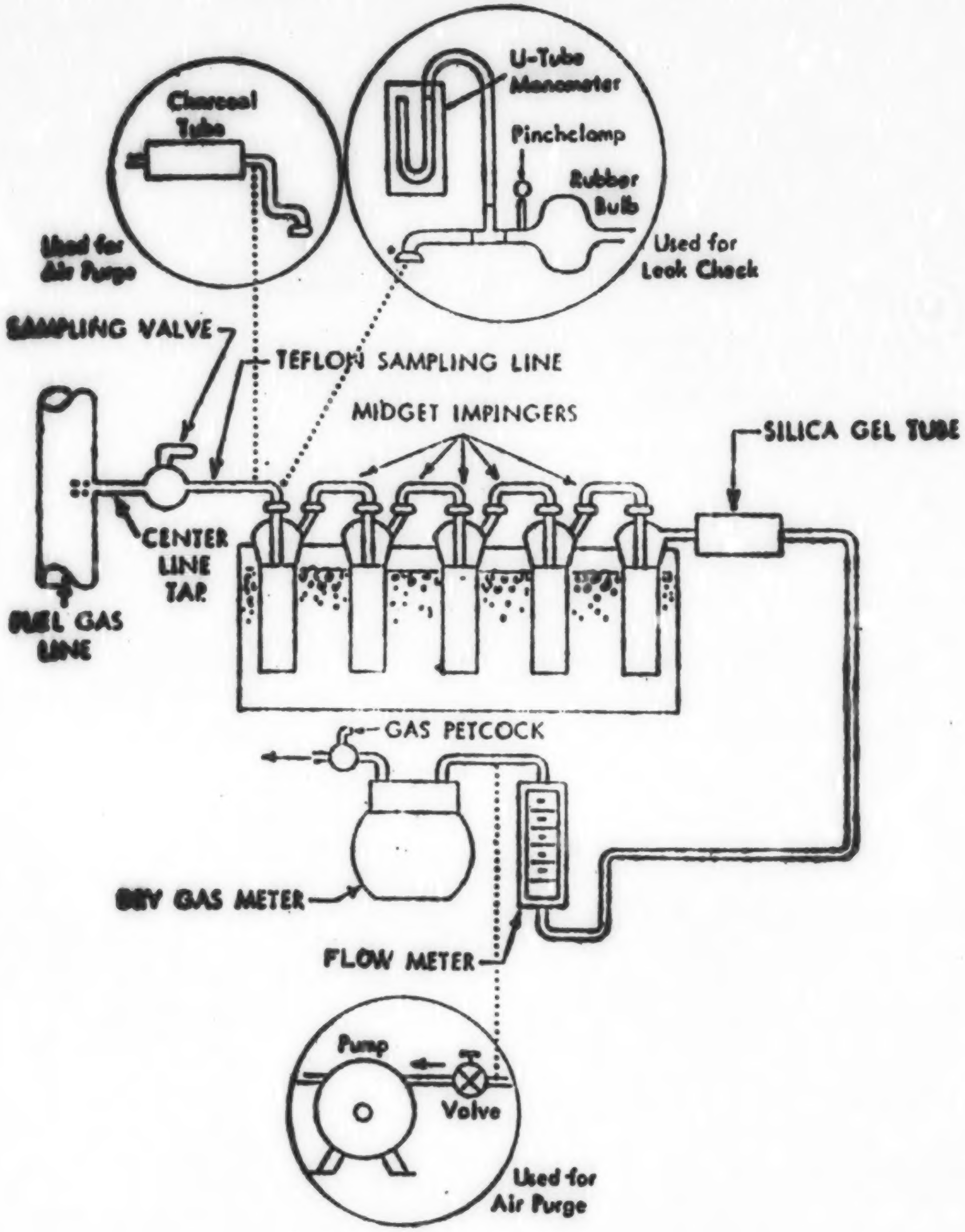
Charcoal Tube
Used for Air Purge
U-Tube Manometer
Pinchclamp
Rubber Bulb
Used for Leak Check
SAMPLING VALVE
TEFLON SAMPLING LINE
MIDGET IMPINGERS
SILICA GEL TUBE
CENTER LINE TAP
FUEL GAS LINE
GAS PETCOCK
DRY GAS METER
FLOW METER
Pump
Valve
Used for Air Purge

Figure 11-1. H_2S Sampling Train

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AMENDMENTS TO REFERENCE METHODS

Method 15 -	Determination of Hydrogen Sulfide, Carbonyl Sulfide, and Carbon Disulfide Emissions from Stationary Sources	see page V-J-8
Method 16 -	Semicontinuous Determination of Sulfur Emissions from Stationary Sources	see page V-BB-7
Method 17 -	Determination of Particulate Emissions from Stationary Sources (In-Stack Filtration Method)	see page V-BB-10